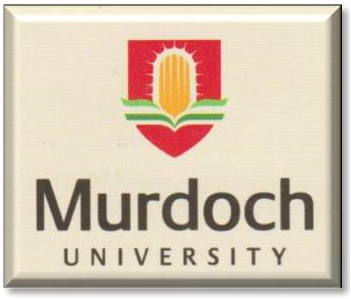

The accreditation role of Councils on Chiropractic Education; The educational journey from craft to profession.

By

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Supervisor and Co-Author Attribution Statements.

I have read and agree with the relevant attribution statements that detail Stanley Innes's contributions, along with my own and that of the other named authors, in the studies detailed in his PhD thesis on which I was either a supervisor or co-author.

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Date 14/6/19.

Author's Declaration

I declare that:

a) The thesis is my own account of my research, except where other sources are acknowledged.

b) The extent to which the work of others has been used is clearly stated in each chapter and certified by my supervisors.

c) The thesis contains as its main content work which has not been previously submitted for a degree at any other university.

[Stanley I. Innes]

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Abstract

Introduction

Economies require healthcare practitioners, such as chiropractors, to assist in providing safe, effective and economical care for lower back pain, globally the leading cause of disability-adjusted life years.

A minority of chiropractors have been shown to have highly undesirable practice behaviours that have implications for public health and patient safety. These practice patterns appear to be associated, to some extent, with the chiropractic program they were trained at. This indicates a need for scrutiny of international chiropractic educational and practice standards.

For chiropractic the establishment and monitoring of educational standards is the responsibility of Councils on Chiropractic Education (CCEs).

Methods

This scrutiny required gaining an understanding of the complex system in which CCEs function. To this end our objectives were to comprehend the "language" of the system by comparing internationally, CCE graduating chiropractic student competency lists and educational / accreditation standards and processes. In addition, we sought to explore the relationship of unsuitable chiropractic practice profiles and various intrinsic and extrinsic factors such as personality, beliefs and attitudes with the clinical decisions of chiropractic students and practitioners.

Results

By comparing all the CCEs accreditation standards and processes we found they became increasingly dissimilar as our research drilled down to describe the various domains and subdomains. Definitions are urgently needed for clarity around key terms. We were able to make recommendations for quality improvements in CCE

standards and processes as well as develop an outcome measure to assist Australian chiropractic accreditation processes.

We also learned that CCEs have enabled a “big tent” approach that allows dichotomous “traditional” and “evidence-based” approaches to clinical care to co-exist. This, combined with the view that chiropractic is “unique”, highly valued, best understood by other chiropractors, explains how students and practitioners can cling to ‘traditional’ thinking and this has implications for public safety.

Conclusion

We conclude that CCEs are in need of re-vitalising and make recommendations to this end. We argue that the “raison d’être” of CCEs is to take a more forthright stand and better serve the patients’ best interests.

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Abbreviations

CAM	Complementary and alternative medicine
CBME	Competency-based medical education
CCE	Council on Chiropractic Education
CCE-A	Council on Chiropractic Education – Australasia
CCE-C	Council on Chiropractic Education - Canada
CCE-USA	Council on Chiropractic Education – United States of America
CCE-E	European Council on Chiropractic Education
CCE-International	Council on Chiropractic Education International
CP	Chiropractic Program
EB	Evidence-based
EBP	Evidence-based practice
FFM	Five Factor Model
IU	Intolerance Uncertainty
W.F.M.E	World Federation of Medical Education

CHAPTER 1. Thesis Introduction

Overview

Historical records for centuries document manual therapists caring for people with musculoskeletal pain [1]. In many cultures this role has been, and continues to be, taught parent to child or master to apprentice [2]. There are many examples such as the Indian tribes of North America, Bone-setting in Britain, Osteopathic medicine [3], and Traditional Chinese and Ayurvedic medicine [4]. Several manual therapies are no longer taught this way and have been integrated into educational institutions. This transition has been described as moving from craft to profession [5].

One of these manual therapies is chiropractic which has been in existence for over 120 years [6]. The early formative thinking of chiropractic was centred on the manual correction of misalignments within the spine (*subluxations*) that interrupted the spinal nerves carrying the flow of *vital* forces. This interference of nerve supply was thought to be responsible for the cause of almost all disease [7]. Today, there is a division between this 'traditional' group that subscribes to the concept that the spine is the centre of good health and the 'evidence-friendly' faction that focuses on musculoskeletal problems based on a contemporary and evidence-based paradigm [8]. However, the majority of chiropractors are somewhere in the middle and do not appear to be greatly concerned with either faction.

Currently chiropractors practice in over 100 countries in which 90 national chiropractic associations have been established [9]. It has become one of the most commonly used complementary and alternative medicine (CAM) therapies in the United States [10], Europe [11] and Australia [12]. Although the number of chiropractic schools and hence chiropractors have increased drastically over the past decades, total utilization rates have not changed appreciably over the past 35 years [13].

This may suggest that the profession is not gaining the level of credibility and cultural authority in mainstream society that is required to establish the vocation on equal grounds with other healthcare professions. Indeed, the chiropractic profession still finds itself in a situation in which it is rated poorly by the public compared to other healthcare professions [14]. In sum, chiropractic remains a healthcare outlier.

Approximately 87% of people who present to chiropractors do so for musculoskeletal pain with two thirds of these being for neck and/or low back pain [13]. These types of musculoskeletal injuries place an enormous financial burden on societies [15]. None more so than lower back pain [16]. This global health issue has resulted in a call to action from eminent researchers involved in the field [17]. Economies require healthcare practitioners, such as chiropractors, to assist in answering the call for safe, effective and economical care [16]. If chiropractic is to have a serious role in addressing this pressing and substantive problem it needs to be better integrated into the mainstream healthcare system [17]. Chiropractic needs to become “respectable”.

Problem statement

For a profession to gain ‘respectability’ it should be located appropriately within the culture of the society, this is evidenced by the existence of professional schools and state licensing or registration, and by doing so, should then able to present itself as an embodiment of knowledge and trustworthiness [18]. Therefore, as a baseline it is important that chiropractic educational programs be seen to be of quality and demonstrate professional homogeneous standards. For chiropractic the establishment of educational standards happens via Councils on Chiropractic Education (CCEs), the goal being to produce chiropractors with similar and high professional proficiency and standards across the globe.

Evidence is available that suggests this is not always the case. For example, in Canada, approximately 18% of the chiropractic population were found to hold ‘traditional’ views and were described as being ‘unorthodox’ or aberrant. These practitioners were

demonstrably differentiated by their low levels of interdisciplinary interactions, anti-vaccination beliefs, selection of non-evidence-based treatment choices, and non-guideline use of X-rays [19]. The education of the chiropractors with 'unorthodox' or 'traditional' practice patterns in Canada has been traced back to six chiropractic programs in the United States. This finding suggests that the United States regulation of chiropractic education may be a factor [20]. Additional evidence of differences in education standards is shown by the 97% pass rate of Canadian chiropractic students on the same Canadian licencing exams for registration on the first attempt compared to 67% of USA graduates [21].

These are not isolated examples. Canadian chiropractic students were found to have increasing levels of anti-vaccination beliefs as they progressed through the chiropractic program (CP) [22]. Concerns were raised over the starting of a paediatric clinic without any evidence of efficacy of chiropractic care for treating specific childhood conditions at the CP at Royal Melbourne Institute of Technology in Melbourne, Australia [23]. Chiropractic students at a North American CP were found to believe that spinal manipulation was an effective primary treatment for AIDS and cancer [24]. Also, chiropractic students in Europe were found to be 20 times more likely to deliver non-indicated care if they held 'traditional' views [25]. European chiropractors who held *vitalist* or *traditional* chiropractic views were able to be identified by the absence of conducting a routine differential diagnosis or strongly agreeing that vaccines have a positive impact on health [26]. Also, recent chiropractic graduates from European CPs perceived that they were underprepared for practice in the areas of interprofessional collaboration, contributing to professional and scientific knowledge, and practice managerial roles [27]. Further that these varied considerably between CPs.

This indicates a need for scrutiny of international chiropractic educational and practice standards. This is in order to identify facets that may require change to enhance the reputation and quality of chiropractic education. The end result would be improved patient safety and quality of care.

Background

The focus of the scrutiny; CCEs

Chiropractors are trained worldwide in different types of institutions; most are private colleges but some are integrated into state funded universities [28]. Accreditation authorities in the first world ensure that there are professional standards that must be met in chiropractic pre-professional training so that patients are protected and treated properly by graduates from those programs. These accreditation authorities are usually empowered or accredited to do this by their respective governments. In this way individual colleges cannot fully determine their own course criteria.

For chiropractic educational institution standards this control mechanism of program accreditation is carried out by various Chiropractic Councils of Education (CCEs). These CCEs are located in North America (CCE-USA), Australia (CCE-A), Canada (CCE-C), and Europe (ECCE). There is also an international umbrella council of chiropractic education organization, the Chiropractic Council of Education International (CCE-International) [29].

Educational standards for the CPs are defined, monitored and enforced by the CCEs. This is achieved, in part, by defining proficiency and creating lists of descriptive statements to clarify the necessary knowledge, understanding, skills, attitudes, and competencies students should attain before graduating and entering practice [30]. These competencies are thought to be an important means by which regulatory bodies can change professional standards of practice [31]. In practice, CCEs prescribe a set of educational standards for CPs which detail, amongst other things, the required program content, facilities, faculty and financial management. Finally, CCEs inspect and monitor CPs for accreditation and re-accreditation compliance and quality improvement. The intention is to lay out the curriculum foundation for the CP and places CCEs as the central actors for enforcement of program standards and any concerns about variable accreditation levels.

Who and what should be "scrutinized'?

Recent research suggests that the notion of changing the standards of a healthcare system by simply setting new regulations is naive [32-34]. Researchers are being urged to see healthcare systems as comprising many elements and groups that can interact in complex, unknown, interrelated and unpredictable ways [34]. This is known as complexity science [35] and has proven to be valuable for gaining insights to enable large scale system transformation [36]. For example, a change in a hospital's standards no longer only engages with the doctors but includes all the 'actors', including allied health practitioners, patients, nurses, managers, policymakers and even the cleaners. These stakeholders have varying but important levels of interest and are now included in consultation and data gathering as they may act as barriers or facilitators to change [32, 33].

The stakeholders or actors chosen for this thesis were those making the standards (CCEs), those engaged in the learning as dictated by the standards (chiropractic students), and those who were educated under CCE guidelines and standards (practicing graduate chiropractors). It is acknowledged that other important stakeholders exist including CP staff, chiropractic registration and licensing boards, chiropractic societies, Government Departments, health consumer groups, and the public at large. However, to explore all of these "actors" was beyond the scope of this thesis.

Recent years have seen an increase in studies exploring medical accreditation [34, 37-41]. This research has identified that a major challenge to accomplishing accreditation and healthcare reform is the lack of a common understanding of the terms and words (language) used by the stakeholders [34]. Because the terms were not defined or clarified, the studies failed to gain a clear understanding of the issues at hand. This in turn negatively impacted on research issues such as the engagement of all the stakeholders, creating a shared agenda, establishing goals, and methodologies for evaluating changes [34]. Therefore, this thesis began by seeking to understand the language of the chiropractic accreditation standards and processes.

The language of the system we sought to scrutinize was found in the written material of the CCEs, namely the documentation relating to accreditation standards and processes. Here lived the definitions, terms, and expectations constructed with the intent of creating a consistent high quality of chiropractic graduates.

Health professions have been shown to use their own specific definitions and competencies [42, 43]. Each of these should contain sufficient detail and clarity to be useful for competency and educational framework development and assessment [44]. Regional variations in these standards have been shown to contribute to poor scores by applicants from other countries seeking USA medical certification [45]. For chiropractors, there is evidence of variations in practitioner attributes and practice behaviours that is related to the country they were trained in [19, 20, 46]. The concern is that these differing profiles or education standards may impact on patient safety and quality of care [47, 48].

One explanation for these differences could be that they are contributed to, at least in part, by different international jurisdiction education accreditation standards and processes. This important topic has not been investigated for chiropractors.

What should be done?

It is believed that a high quality medical education and accreditation system will improve the quality of patient care [49]. In addition, if these homogeneous high quality standards are internationally consistent then this may increase employment opportunities by increasing international mobility with better inter-jurisdictional recognition of similar educational program structures and standards [50]. The same may be said for chiropractic education and accreditation. If it were known that CCE standards were globally uniform, then it may be possible to create a single set of high quality, international standards. Such studies have been undertaken for medicine with the intent of producing a single, high quality curricular resource infrastructure [42, 45, 51].

Other factors outside of the regulatory mechanisms may also contribute to practitioner competence. Medical research has identified factors such as personality [52], attitudes [53] and beliefs [54]. No study has looked to see if factors such as these are relevant to the competent practice of chiropractic. Knowledge such as this may inform chiropractic regulators, accreditors, and educators of appropriate and adequate clinical practice standards. As such, chiropractic is lagging behind other health professions in this regard.

Having regard to the above, the following objectives were proposed:

Thesis Objectives

Objective 1: To compare the various Councils on Chiropractic Education (CCEs)

a) definitions of competency
b) graduating chiropractic student competency lists

Objective 2: To compare CCE educational / accreditation standards

Objective 3: To determine if CCEs use the same standards and processes for inspection teams when inspecting chiropractic educational institutions.

Objective 4**.** To compare the final reports of CCE site inspection teams with CCE accreditation standards.

Objective 5: To explore the relationship of unsuitable chiropractic practice profiles and clinical decision making with various intrinsic and extrinsic factors in students and practicing chiropractors and the consequent implications for CCE accreditation standards and graduate competencies.

Literature review for thesis objectives

Below is a review of the literature directly related to the objectives of this thesis. It is set out by re-stating each of the thesis objectives and then exploring the literature around each individual objective.

Objective 1: Comparison of CCE definitions and graduate competencies

Objective 1 (a): Definitions of Competence.

A literature search was conducted to define competence as it relates to chiropractic accreditation standards.

Search terms for Objective 1(a) and (b);

("Education"[Mesh]) AND ("Education, Medical/education"[Mesh] OR "Education, Medical/standards"[Mesh])"Education, Professional"[Mesh]) OR "Education, Professional/standards"[Mesh])) AND "Education, Medical"[Mesh]) AND "competen*"

Databases; Pubmed, Scopus, Academic Onefile, ERIC
Timeline of database searches: From inception until 2019
The reference lists of key articles were also reviewed.

Background; defining competence

The Oxford Concise Dictionary defines competence as "the ability to do something successfully or efficiently"[55]. The conceptualisation and defining of competence has important implications for the way that competence based medical education (CBME) is implemented [56]. It is generally agreed that a greater level of specificity and detail than that found in the general literature is required to make it useful for health professionals' educational curricula formation [56-58]. Definitions of competence have

been used to inform how competencies were constructed [56]. Here lists of expected behaviours, skills and knowledge were constructed that thought to identify the competent individual [59]. Today the concept of competence is extensively applied to describe expectations of graduating students in medical and allied health professions [30]. Considerable problems remain with a lack of clarity surrounding defining competence [56], also the descriptive language of healthcare accreditation in general [34].

The difficulty of trying to define competence for the health professions

Definitions of competence in areas outside of medicine, such as in industrial and organisational settings, characterise competence as a complex entity composed of four broad components [60]. These are knowledge, skills, abilities and 'other' attributes.

A systematic review by Fernandez et al., (2012) compared definitions of competence across publications related to medical education and suggested that competence was best conceptualised by only three components; knowledge, skills, and 'other' [56]. Abilities and attitudes were combined under 'other'. However, ability was viewed as being most commonly composed of abstract reasoning, memory and the cognitive processes associated with solving novel questions, while attitudes was related to personal characteristics or values such as tolerating uncertainty, aspects not formally taught but gained through experience and personal growth [61]. Finally, definitions of competence were found to vary considerably in their stated purpose and cultural context [56].

This diversity of definitions of competence has been attributed to the belief that one broad definition is not suitable for all professions [43]. Thus each profession will likely have specific definitions and detailed competency lists influenced by its specific cultural context [44]. Consequently, because cultures and professions change over time these definitions of competence require regular reviews [62].

This diversity of definitions of competence and competencies has created a level of uncertainty for a variety of international regulatory and educational bodies [57]. This

inconsistency has in turn presented significant challenges to the generalised adoption of high quality standards across the continuum of education and regulation [57]. These challenges include poorly defined curriculum components, compromised learning objectives, and poor and varied assessment approaches in medicine. The end result of which, may confuse learners, compromise their achievements [57] as well as present an obstacle for sharing best practices in teaching and assessment internationally [63].

Other studies and editorials have echoed these thoughts in nursing, medical specialities, and regulatory science training [47, 56, 63-66]. There currently exists international interest in developing a consensus by working toward developing consistent definitions and models for education and assessment among medical educators [42, 57]. An extensive search of the available chiropractic and medical databases failed to find any research to this end for chiropractic education or regulation.

Summary

It would seem logical to assume that these conceptual and educational difficulties for medicine and other allied health disciplines are also relevant for chiropractic. In addition, it is timely in this current climate of competency based medical education (CBME) reflection and research for medicine, to conduct a similar review of chiropractic conceptualisations and definitions of competence. In particular, it should compare the similarities and differences of components adopted by the chiropractic regulatory bodies to define competence and where possible, also examine the intended purpose and context.

Objective 1 (b); Graduating chiropractic student competency lists

Introduction and history of competencies

In the broader commercial community, a competency is defined as a set of observable performance dimensions, including individual knowledge, skills, attitudes, and behaviours, as well as collective team, process, and organizational capabilities, that are linked to high performance [67].

The competency movement was originally initiated by David McClelland in the 1970's as an alternative to the trait and intelligence approaches to measuring and predicting human performance [68]. Originally applied to the field of educational achievement testing, the competency approach was soon adopted for business and manual trade applications. McClelland described competencies as "clusters of life outcomes" (p. 15). In the commercial setting this concept shifted to view competencies as knowledge, skills, abilities and other characteristics that differentiate high from average performance [67].

In the past decade medical education has moved away from a time-based or prescriptive system where a student spends a fixed amount of time on a particular rotation or a prescribed number of patient treatments to produce competent practitioners [63]. Instead it has moved towards adopting an outcomes-based model where the physician is defined by a set of measurable abilities (competencies) [69]. Competency-based frameworks divide competencies into measurable subcompetencies and the student is graded on the serial completion of each of these stages or milestones [57].

Educators are expected to comprehensively teach and assess the defined competencies [63]. This allows for the setting of clear standards and frameworks to be met and provides a means of ensuring accountability. Other health professions have been influenced by the path that medical education has chosen and have also adopted

a competency-based medical education (CBME) approach. However, CBME is not without its concerns and challenges.

The upside of a competencies approach.

CBME approach offers several advantages. These include: a focus on outcomes and learning achievement, enabling the use of a multifaceted observation-based assessment approach that embraces formative assessment, the support of a flexible learning and time-dependent trajectory along the continuum of education, and increasing transparency and accountability to all stakeholders with a shared set of expectations and a common language for education, assessment and regulation [70].

Studies have demonstrated educational and clinical benefits from implementing CBME frameworks. These include improved procedural skills in residents and reduced complication rates [71], improved clinical skills and patient care by surgical residents [72], and a more rapid acquisition of procedural skills [73]. It has also been shown to result in an increased ability of authorities to identify unprofessional behaviours in medical schools [74].

The downside of a competencies approach.

Experts have raised concerns that clinical competence may not be represented by the sum of its subcompetencies. Competencies are typically derived by a consensus process involving large numbers of experts, stakeholders and interested parties [75]. They tend to be cast in global and overarching terms. Some competencies have been described as complex and challenging to define and measure [64]. Examples would include altruism and professionalism. Efforts to further enhance the description for assessment purposes have led to the creation of divisions of these competencies into simpler, smaller, and specified units of behaviour. This reductionist approach requires a balance between insufficient and excess details. An exhaustive detailed approach is thought to lead to bulky, fragmented subcompetencies descriptions that become less and less connected to the real world of clinical practice and removed from the intended competence [76]. Consequently, concerns have been expressed that 'ticking

the box' for successful attainment of each subcompetency for a student does not mean that they are necessarily competent. What is required are descriptive lists of competencies and subcompetencies that contain an adequate and appropriate level of detail for their intended purpose. For this thesis, this would be for the competent practice of chiropractic.

Critics have suggested it may not be possible to describe some competencies and capture the necessary knowledge skills and abilities required for competent medical practice [59]. Competencies are thought better applied to routine tasks and less complex skills and abilities [57]. For example, it is very difficult to describe and assess higher order thinking which involves dealing with complex multifaceted patient presentations in varying clinical contexts. Because of this some domains may be omitted or receive limited attention in competency lists. Examples of this include medical students' intolerance of uncertainty [77], the ability to respond to events as they unfold [78], assuming responsibility and reflection on clinical practice [79]. It is possible that these examples may also be applicable to the competent practice of chiropractic, which involves higher order complex thinking. This has not been investigated in chiropractic education.

Concerns have also arisen in medicine and other health professions' competency frameworks as a result of variations in the language used to describe specific outcomes across cultures [42, 69]. Different cultural influences may result in variations in competency lists [42]. For example, it is common practice to compile competencies by seeking consensus from experts from within a specific culture. The Australian CCE may source information from its major stakeholders and Australian academics. Australians may place a very different emphasis on communication when compared to Canadians resulting in differing subcomponents for this competency. One chiropractic commentary article has recognised the potential for cultural differences in educational standards, but has stated that there are nonetheless core skills which should be regarded as minimal [80]. Unfortunately, this commentary did not specify what these should be. Medical research has responded to the potential for cultural influences by seeking empirical, evidence-driven models of professional practice characteristics

wherever possible [57]. No investigation has compared chiropractic competency lists for similarities or differences to see if there are core minimal skills, knowledge, or attitudes or cultural variations in these.

The potential benefits of a common high quality set of competencies

A common set of competencies for physicians across the medical education continuum is thought to enhance the continuity of standards across all health professions and communication between health care settings [47, 81]. This also provides a means of exploring the comparability for credentialing bodies on standards for the maintenance of competence and facilitate a mutual understanding of expectations, in order to build credibility for improved international workforce mobility [81]. Finally it would provide a common standard and language from which research could be conducted to continue to develop these standards and shape educational curricula for the benefit of all health professions and ultimately for improved patient safety and quality of care [42].

Summary

Competency based approaches are now broadly adopted by educational and regulatory bodies for the training of health professionals. There is a substantial body of research identifying the presence of considerable variability within this approach for medical education. This has resulted in a diversity of competence and sub-competency descriptions. This variability has been shown to exist across health professions and within the same profession but from different nations. Concern exists that this may result in variable standards of practice which could impact on patient safety. Studies have explored this in the medical profession resulting in the ability to identify areas within medical programs found to be substandard [45]. No such research exploring the possibility of variability has been conducted for the chiropractic profession despite evidence it exists and is resulting in undesirable practitioner profiles [20]. What is required is a comparative study of international competencies looking for similarities and differences of domains of competence and subcompetencies.

Objective

To achieve this the following objective is proposed;

Objective 1: Compare the competencies expected of a graduating chiropractor by the various CCEs for similarities and differences and make recommendations for a uniform high quality set of internationally acceptable standards.

Objectives 2, 3 and 4. Comparing CCE Educational / Accreditation Standards, Process for Accreditation and Re-accreditation.

Objectives two, three and four will focus on accreditation standards as they apply to chiropractic educational programs. In particular, the comparison of the written standards, inspection processes, and past reports by schools and regulatory authorities on perceived levels of compliance between the CCEs. Due to the large overlap of the subject matter, this review will combine the three objectives into one before detailing the thesis objectives.

MeSH search terms; "Health Care Quality, Access, and Evaluation/education"[Mesh] OR "Health Care Quality, Access, and Evaluation/methods"[Mesh] OR "Health Care Quality, Access, and Evaluation/prevention and control"[Mesh] OR "Health Care Quality, Access, and Evaluation/standards"[Mesh] OR "Health Care Quality, Access, and Evaluation/trends"

Definitions of terms

Regulation: "sustained and focused control exercised by a public agency over activities that are valued by community" [82].

Standards: Standards relate to different aspects of medical education, and are presented in such a way to make possible assessment of a graduate's performance in compliance with generally accepted professional requirements [83]. Standard establishment is a process of decision making on what is acceptable and what is not. A standard is both the goal (*what should be done*) and a measure of progress towards the goal (*how well it was done*).

Accreditation: is a process by which official accrediting bodies evaluate institutions using a set of criteria and standards, following procedures to ensure high quality education needed to produce competent graduates [84] (pg 35).

This literature review identified a number of studies that contained relevant information on accreditation but related to health services and not healthcare practitioner education. For example, hospitals and age cared facilities. There was considerable overlap between health services and educational accreditation for healthcare professionals. Both require the formulation of accreditation standards, as well as the inspection and monitoring of adherence to the expected stipulated competencies and behaviours of these health-related organisations. As such, this thesis drew on this valuable information where appropriate and has identified the instances where this has happened.

Introduction

Independent and external agencies are often required to review educational programs to ensure they meet agreed-upon standards in a process known as accreditation [85]. In the broader educational landscape the basics are well known; a set of prescribed standards, a self-study of attaining these standards, a review by peers and a decision from a commission [86]. An examination of the research from the medical and educational environment would suggest that although the process might be well known and widely utilized there are concerns about how this process is carried out [87]. This section of the review will outline the current theoretical concepts, definitions, frameworks, and their relative strengths and opportunities for improvement of regulatory and accreditation processes. This will begin with the

broader educational and medical environment where there is more literature available for analysis. It will conclude with suggestions for a study with respect to the chiropractic educational accreditation process where there is a paucity of such evidence.

The aims of regulation / accreditation

In the broader community a central entity - the regulator- is usually empowered to act on behalf of everybody, rather than individuals being expected or even entitled to do so for themselves [88]. Regulation is often presented in order to address conditions such as monopolies, major information imbalances between buyers and sellers and holding to account powerful professions or corporate interests. The intent of the processes is to change the behaviour and performance of organisations and institutions [88]. Regulation is used to protect the public, serve social goals and implement social values such as equity, diversity, social solidarity and compassion [83].

It is generally agreed that regulatory standards and processes should aim to be fair, transparent, and objective [89].The standards should be explicit so that they make compliance straightforward and non-compliance easily determined [90]. This potentially reduces the scope for variability in professional judgement and discretion on the part of regulatory staff, so that the process is more reliable and rigorous [91]. Despite the apparent simplicity of these stated aims, the reality is complex and a subject of concern for those engaged with educational standards and the accreditation processes [92-96].

Concerns over regulatory methods and processes;

The educational standards

Chiropractic regulatory and accrediting bodies construct educational standards that are intended to establish a system of evaluation and accreditation of institutions teaching chiropractic to assure minimum quality standards. These are also intended to stimulate institutions to formulate their own plans for change and for quality improvement. This review has raised concerns over variations between chiropractic

accreditation standards internationally [27, 80]. Evidence shows that these variations are also found in the regulatory processes and standards for general and medical educational institutions nationally and internationally [87, 97].

The research investigating healthcare practitioner educational standards has questioned the capacity of regulatory standards to quantify what they are purporting to measure [85, 98-102]. Medical educators, when interviewed, commonly expressed a desire for measures that demonstrated that regulatory standards were related to improved quality of health care and / or practitioner performance [98]. To this end medical educators called for standards and regulatory processes to be based on evidence [85]. Further, educators wanted demonstrable measurable evidence that accreditation was effectively assessing compliance as well as improving the quality of health care [100]. Educators were found to believe that standards were not constructed with a clear purpose and theoretical framework in mind [97]. Instead standards were perceived as often being developed in response to a particular problem for one profession and then applied to all health professions [103]. Disconcertingly, it has been found that medical education regulatory boards often do not appear not be aware of quality measures of educational outcomes or, if they do exist, of trying to find ways to integrate them into their standards and processes [87].

Not everybody wants to move to a CBME approach. Some educators have been found to want regulators to be very specific with definitions of standards [83, 97, 98]. This was based on the assumption that specificity and specific requirements allows for easier compliance and detection of non-compliance [90]. More recent research has suggested the best way forward is a 'hybrid' model for standards that combines a prescriptive and outcomes-based approach [104]. In addition they should be regularly updated to reflect changing attitudes and values in society [105]. One example of a contemporary societal value that has only been partially adopted into standards for medical education is the trait of practitioners becoming lifelong learners [105].

The cost

Accreditation for both health organisations and healthcare education processes come at a considerable expense [88]. The organization under review will usually bear the cost of interacting with the regulator, preparing evidence, responding to communications, hosting survey visits, and licencing fees [88]. There is also the impost of making changes to comply with accreditation findings. Research suggests that there is little attention given to consequences of complying with regulations and standards and that there are minimal incentives for regulators to minimize associated costs [100]. Interviews with regulatory authorities indicated they felt it was simply the cost of doing things right [88]. In contrast, interviewed educators stated that the efforts required to meet accreditation standards were excessive and reduced the available educational resources for more productive behaviours, creativity and innovation [88]. To this end these medical educators asked for lists of standards and competencies that were minimal and efficient in measuring what they are purported to access.

In summary, when the evidence and opinions are combined, regulatory standards and processes should be efficient and cost effective for educational institutions and healthcare organisations seeking accreditation, whilst still performing their intended function of quality assurance and improvement.

The regulators

Studies have shown varying levels of regulators expertise and understanding of the disciplines activities they accredit [106]. Suggestions to rectify this have included improving the transparency and accountability of the survey processes, regulatory board findings, and selection processes of inspection team members and regulatory board members [91, 98].

Regulators commonly use surveys as part of their assessment process [49]. However, the survey methods, models and theoretical frameworks have been shown to vary considerably [88]. To date this question of the reliability and validity of regulatory survey processes has not been answered [88, 98, 100]. There has been a trend toward improving consistency levels through the use of extensive manuals, highly structured

pre-planned survey schedules, software for collating results & regular surveyor training [90]. Regulators bemoan having insufficient time to obtain a meaningful understanding of an organization. This task is further complicated by healthcare organisations tendencies to try to put forward the best possible picture and not draw attention to problem areas [88].

Adverse findings against medical practice appear to increase preventative behaviours that address known risk factors in teaching institutions and hospitals [100]. Knowledge of disciplinary action and malpractice claims within professions has not been used as a quality signal to teaching institutions nationally or internationally [107]. Using this logic, the dissemination of national and international accreditation findings and actions by regulators could be one way of improving the accreditation process and standards for medical educational institutions and possibly chiropractic as well.

These findings infer that regulatory bodies should employ an evidence-based approach to surveys and educational outcome measures. Staff selection by regulators and the design of assessments should be conducted in a transparent manner. Finally, the detailed findings of educational institutions inspections should be made known openly and internationally for use by all chiropractic teaching institutions.

Regulatory impact.

There is not a consensus on the degree and dimensions of the impact that regulatory changes have on a target healthcare organization's or healthcare educational institutions behaviour or performance [88, 108]. As discussed in the background section of this chapter, accreditation and regulation matters are becoming increasingly seen as complex and difficult to understand. However, for healthcare organisations, inappropriate regulation may have detrimental effects by absorbing important and limited resources undermining other important activities [109]. Some guidelines have been suggested as indicators of accreditation having a positive impact [88]; Does it force organizations to think afresh about systems and processes? Does it make institutions look outside their own boundaries and compare themselves with others?

Does it force overdue tasks to get completed? Does it focus on conformance behaviours which produce important and productive behaviour processes? Does meeting regulatory standards leave time for innovations and creativity or are they stifled because change does not exactly fit the current regulations? However, while these are valuable insightful questions, they are at best indicative. Other studies have called for the implementation of quality outcome measures to monitor regulatory impact [49, 102, 108].

In sum, there is a lack of outcome measures available for stakeholders to establish whether accreditation results in positive outcomes as evidenced by improved educational standards and competence levels of its graduates.

Literature specific to chiropractic educational standards / accreditation

Databases searched; Chiroaccess, Pubmed, SCOPUS, ERIC

Search terms “chiropractic” AND “education” AND “regulat* OR accreditation”.

A search of databases revealed a paucity of literature with respect to the regulatory standards and accreditation for chiropractic education. There were only three articles identified and these were commentaries on accreditation standards of chiropractic education [80, 110, 111]. All acknowledge the presence of differences in standards nationally and internationally, and two of these expressed the need for an accepted international standard. These two authors recognised the need to consider cultural differences and scope of practice, as well as a minimum standard at which primary care practitioner must be expected to function within the community in which they are trained [80, 110]. Unfortunately, this minimum level was not specified. One discussion paper recommended the formation of an international standard which should be based on professional accreditation, educational quality, clinical practicum and institutional integrity [80]. Another commentary reflected on the difficulty that the differences in chiropractic philosophical groundings imposed on the possibility of self-regulation [111]. That is some chiropractic care as treating musculoskeletal problems while others see it as additionally treating a wide range of medical conditions [8].

Reflective of this divide is the World Health Organisation (WHO) guidelines on Training and Safety in Chiropractic Education [112]. The WHO guidelines for chiropractic education were published in 2005 and make extensive use of the terms “subluxation” and “vertebral subluxation complex”(pg 4,6) for course content construction. In light of recent statements by Australian, European and South African educational institutions refuting this term and relegating it to a concept only to be taught in a historical context, this would no longer appear to be an appropriate guideline standard [113]. Further, these WHO guidelines do not contain any recommendations for governance, structure and administration, educational facilities and resources, student management or program evaluation which are common domains in educational standards of CCEs. These omissions make it an inadequate framework for comparing international standards. The WHO have recently released their international standards for medical education (WHO/World Federation for Medical Education (WFME) [51]. These guidelines are based on science and an evidence-based approach to practice and have quickly gained a wide acceptance internationally. The WFME standards may offer a framework from which to compare and contrast the chiropractic standards with for the identification of potential areas of synergy and deficiency.

Summary

This section has continued the theme of exploring the issues surrounding accreditation standards and process set by external and independent regulators in order to ensure organisations meet stipulated standards. A review of the literature would suggest that there is concern over the construction and measurement of these educational standards, the levels of specificity, and assessment measures and processes employed by regulatory authorities. The available limited chiropractic research is cognisant of the possibility of differing national and international standards, but this has never been studied.

Chiropractic educational standards and their assessment are undertaken by CCEs. Commentaries have suggested differing standards and the need for an international set of high standards [80]. There has been no comparative study of similarities or

differences of educational standards, inspection staff selection or training, assessment measures, and levels of transparency used by the various CCEs.

Capturing and comparing available data such as CCE educational standards, chiropractic educational institutions self-evaluation reports, CCE reports of findings with respect to their educational standards and assessment procedures and comparing them would be very useful for several reasons;

First, by looking at similarities and differences in educational standards of various CCEs it would potentially allow for identification of the most effective, comprehensive and efficient set of educational standards and regulatory processes. This may lay the foundations for the creation of measures to assess CP curricula and student learning outcomes. The intent is to begin the process of improving educational standards validity, reliability and specificity.

Second, by comparing CCE final site report findings, internationally common areas of concern for regulatory site visits could be identified. This may also lead to the establishment of initial benchmarks and the identification of past successful strategies for quality improvements of chiropractic teaching programs.

Third, by comparing CCEs site inspection team selection and training processes, site report structure and criteria for assessment a more transparent, efficient, reliable and valid process could be created.

Fourth, universally accepted high quality educational standards could lay the foundation for mutual recognition and increase international workforce portability.

Finally, this has the potential to improve chiropractic education and educational outcomes and improved quality of patient care and safety.

Objectives

To achieve this the following objectives are proposed;

Objective 2: Compare accreditation / educational standards of the various CCEs for similarities and differences and make recommendations for a uniform high quality set of internationally acceptable standards.

Objective 3: Compare CCEs site inspection processes of CPs and make recommendations for improvements for standardisation. This would include; levels of transparency for the selection, training and instructions provided to inspection teams, as well as the process of report construction and the report of findings.

Objective 4: Determine if a sample of chiropractic educational institutions consider that they fulfil these standards according to their self-evaluation reports and where possible compare and contrast this with CCE final inspection reports and accreditation standards.

Objective 5: To explore the relationship of signs of unsuitable chiropractic profiles and clinical decision making with various intrinsic and extrinsic factors in both chiropractic students and practitioners and the consequent implications for CCE accreditation standards and graduate competencies.

To better understand this objective, it is necessary to define the following terms [77]

Performance: is the action or process of performing a task or function

Competence: is an ability to do something successfully or efficiently

Competency: is often used interchangeably with competence but should be used for the 'skill' itself.

MeSH Search terms: ("Education, Medical/education"[Mesh] OR "Education, Chiroprac*/standards"[Mesh])"Education, Professional"[Mesh]) OR "Education, Professional/standards"[Mesh]) AND ("Human Characteristics, Personality" [Mesh]) AND (Health Care, Quality of health care" [Mesh]).

Databases; Pubmed, Scopus, Chiroindex.

Introduction

This review has largely discussed the relationship of extrinsic factors, such as educational and regulatory factors, and the likely consequence for improving the competence of chiropractic graduates and the consequent quality of patient care. This review of objective 5 will now consider the role of intrinsic factors. The internal motivating or driving forces such as personality, abilities, beliefs and attitudes may impact on graduate competence and therefore become relevant for inclusion in accreditation standards and processes. This thinking is based on meta-analytic

research findings from school and work domains indicating that intrinsic motivation is a medium to strong predictor of occupational performance [114]. An understanding of intrinsic factors and their influence on student and practitioner behaviours and clinical decisions goes beyond existing regulatory factors and could inform accreditors', regulators' and educators' strategic thinking for quality improvement accreditation standards and processes for chiropractic education and subsequent practice.

Basic Facts

There are a number of individual different attributes that contribute to intrinsic motivation which in turn affect occupational performance. These have been found to include a hungry mind or intellectual curiosity [115], interests and abilities [116], sex [117] and personality traits [118]. The literature relating to these four areas is vast and beyond the scope of this review. Instead this component of the thesis will focus on the important domain of personality, an area where there is existing research in medical education and practice showing its relevance and importance to practitioner competence and health care delivery quality.

Personality and its relationship to performance.

Personality is important because it has been shown to be a medium to strong predictor of occupational performance [114]. Personality structure is now well understood in terms of a robust construct known as the five-factor model (FFM) [119]. These five factors are universally known and have been shown to be reliable and valid constructs [120]. Past meta-analytic studies have shown that by knowing a person's FFM personality structure it is possible to predict their levels of counter productive work behaviours [121], academic performance [122], corporate citizenship behaviours at work and performance levels on job tasks [123], psychopathy and narcissism [124], levels of creativity [125], performance motivation [126], relationship dependency tendencies [127], levels of overall adaptive performance at work [128], and individual differences in religiousness [129]. While these underlying personality dispositions have been found to be stable, patterns of behaviour are amenable to change [118]. For

example “I am not a detail-oriented person but I have learned to act that way in work settings because that is what the job I value demands”. Interventions targeted at changing patterns of behaviour such as this, have been shown to result in more successful work experiences [130].

The FFM has been used to explore the relationship between allied health practitioners and job performance and has offered valuable research and performance insights. [131-136]. Personality research has not been applied to chiropractic practice.

The five-factor model (FFM)

Despite many models having been proposed for personality, the FFM has emerged as the dominant model in personality construction and understanding [119]. The development process of the FFM found that it converged into a five factor structure [137]. These were extraversion (versus introversion), agreeableness (versus antagonism), conscientiousness also called constraint, neuroticism (emotional instability) and openness (unconventionality). Subsequent research has further differentiated each broad domain into more specific facets [138]. For example, the six facets identified for agreeableness were trust, straightforwardness, compliance, altruism, modesty, and tender-mindedness [139].

The first two domains of personality have consistently been identified as extraversion and agreeableness [119]. These aspects of personality functioning are considered to be most important across all cultures and languages when describing how people relate to one another.

The third domain extracted was conscientiousness. This domain relates to the control and regulation of behaviour. It is often described by words such as disciplined, dutiful, conscientious, and deliberate. The fourth domain, neuroticism (emotional instability) is of considerable importance in mental and medical health, saturating most measures of personality disorders [140]. Emotional stability is represented by terms such as anxiousness, depressiveness, irritability, volatility, anger, and vulnerability.

The fifth domain, openness or unconventionality, reflects a culture or society's interest in creativity, intellect, and imagination and is contrasted with words such as closed minded, practical, conventional, and rigid. This domain shares similar characteristics with the concept of intolerance of uncertainty and will be discussed in more detail later on.

The FFM has amassed a considerable body of empirical support, including multivariate behavioural genetics with respect to its structure [141], neurobiological correlates [142], childhood antecedents [143], temporal stability across the life span [144] and cross-cultural validity [145].

More recent findings when studying specific professions have found variations of levels for each of these personality factors and job performance, but these have not included the education or practice of chiropractic [118, 131, 146].

*How is this important to chiropractic education and accreditation?*As previously mentioned no study has looked at the relationship between personality factors and performance levels in chiropractic practice or education. The FFM offers the potential to explore this and its relationship to sustained competent practice. For example extroversion and agreeableness directly impact on a medical practitioner's ability to communicate to patients [119]. Conscientiousness has consistently been shown to be related to academic performance [147]. Knowledge of patterns of FFM in chiropractic students and practitioners in general, or individual variations, could inform chiropractic educators and regulators of

1. Students not suited to the chiropractic program
2. Areas of the program a student is likely to find difficult
3. Areas in the curriculum and competencies which warrant additional attention because of common personality patterns in chiropractic students
4. Sustained competent practice

Practice behaviours are amenable to change and identifying these patterns in students and practitioners has the potential to improve educational outcomes as well as the levels of chiropractic patient care. Because of these possible benefits, a study exploring

the relationship between FFM levels and competent practice in chiropractors is highly desirable.

Other potentially important factors: Intolerance of uncertainty (IU).

Intolerance of uncertainty (IU) refers to a dispositional tendency to view the occurrence of negative events as unacceptable and threatening, regardless of the possibility of those events actually happening [148]. Individuals who have high levels of IU hold a set of negative beliefs about uncertainty in everyday situations. This results in a desire for predictability and the tendency to adopt inflexible uncertainty beliefs [149]. *f*MRI findings suggest that the neural response pattern in IU demonstrates that uncertainty is viewed as threatening and a lack of adequate cognitive mechanisms to cope with the uncertainty [150]. This fear, which among other things, leads to excessive concern over making mistakes and has been associated with lower levels of behavioural performance tasks [151].

More broadly, these beliefs are thought to stem from a fundamental fear of the unknown [152]. A recent meta-analytic study has suggested that IU has robust relationships with psychopathologies such as generalised anxiety disorder, depression and obsessive-compulsive disorder [153]. Some have suggested that IU may underlie a number psychopathologies [154]. In contrast those who do manage ambiguity / uncertainty (low levels of IU) demonstrated a tendency not to resort to black and white solutions [155]. They experienced little discomfort with ambiguity and could deal with having positive and negative features for the same object. They tended to engage in and enjoy complex problems and avoid simplistic solutions.

Results from structural equation models provide consistent support for the hypothesis that uncertainty avoidance (e.g., need for order, intolerance of ambiguity, and lack of openness to experience) and threat management (e.g., death anxiety, system threat, and perceptions of a dangerous world) contribute independently to conservatism [156].

IU and Medical Practice

There is a rich history of research exploring the relationship between IU and health care practitioners. The art of clinical medicine involves learning to deal with varying levels of ambiguity and uncertainty (equipoise) and studies of IU levels in medical students indicate that it decreases over the course of training [157]. Those medical students whose levels do not decrease experience higher levels of psychological distress [77].

Higher levels of IU have been linked to the quality of healthcare delivery. Australian GP's with high levels of IU, when compared to those with lower levels of IU, were found to deliver lower levels of quality of care, experience lower levels of job satisfaction, and were more at risk of burnout [53]. Physicians high in IU have been found to be poorer communicators in the face of unknown patient outcomes or diagnosis [158]. Surgeons demonstrated more extroversion, less neuroticism and had higher levels of IU than physicians [159]. The authors of this study suggested that surgeons were less capable of experiencing clinical equipoise. In this study age and sex were independent predictors of IU. Finally, physiotherapists high in IU were more likely to think that LBP was due to biomedical factors and down play psychosocial factors [160]. Psychosocial factors are known to be the largest contributor to poor outcomes for those treating and experiencing low back pain [17], the second largest financial burden on developed economies [161]. IU can therefore be a barrier to optimal care.

The unsuitable chiropractic profiles discussed in Chapter One were identified by practice styles typified by conservative chiropractic philosophical beliefs, technique styles, and X-ray usage [20]. This review raises the possibility that levels of IU and FFM may play a role in the choice of these unsuitable practice profiles.

The Problem: The quality of chiropractic practice is variable

Patients report a high level of satisfaction with chiropractic care [162, 163]. Despite this there is evidence to suggest that patients still have concerns. In a United Kingdom study of first attendance at a chiropractic clinic patients, revealed that the majority

had an inaccurate understanding of the treatment and had concerns about the nature of the treatment suggesting communication difficulties [164].

There is also evidence that the clinical performance of chiropractors could be improved. A North American study found that there is considerable variation in clinical performance quality within the Department of Veterans' Affairs chiropractic clinics [165]. Data and interviews with the hospital administration where the chiropractic clinics were located revealed that higher quality of care and more consistent delivery of chiropractic service was been found to be associated with a higher degree of perceived level of being evidence-based in these clinics. Poor clinical performance was evidenced by the majority of chiropractors not using psychosocial questionnaires or condition-specific disability and disability indices to document baseline or subsequent changes in health care status [166]. Deficiencies have also been noted in communications between general practitioners and chiropractors in Norway, particularly with regard to frequency and written quality [167]. Finally, chiropractors who had chosen to no longer practice thought that business ethics in chiropractic practice were questionable and that associates were encouraged by the practice owners to unnecessarily prolong the care of patients [168].

Health promotion, as a clinical competence, may be suboptimal in chiropractic practice. This is evidenced by the finding that chiropractors can be doing more to manage arthritis through suggesting modification of lifestyle [169], greater exercise levels and more closely adhering to recommended guidelines for care [170]. The chiropractic-patient relationship is thought to be an inadequately used mechanism for advancing and implementing evidence-based care to improve patient outcomes who are struggling with arthritis [171].

Canadian chiropractic students were found to have increasing levels of anti-vaccination beliefs as they progressed through the CP [22]. Concerns were raised over the starting of a paediatric clinic without any evidence of efficacy of chiropractic care for treating specific childhood conditions at the CP at Royal Melbourne Institute of Technology in Melbourne, Australia [23]. Chiropractic students at a North American CP were found to

believe that spinal manipulation was an effective primary treatment for AIDS and cancer [24]. Finally, chiropractic students in Europe were found to be 20 times more likely to deliver non-indicated care if they held 'traditional' views [25].

These findings, and those of the unsuitable practitioner profiles [19, 20, 46], add weight to the argument there is scope for improvement of chiropractic performance across a range of clinical areas.

IU and vitalism

Vitalism is described as a vital force, of supplemental, extra-causal agents powering the living body [172, 173]. The emphasis is placed on the recognition and respect for the inherent, self-organizing, self-maintaining, self-healing abilities of every individual [173]. Some see this as diametrically opposed to the mainstream healthcare evidence-based approach that is underpinned by a mechanist, reductionist or empiricist viewpoint [174]. There is evidence that a considerable portion of chiropractic practitioners and educators see chiropractic as being based on a *vitalist philosophy* that centres on the correcting of vertebral subluxations [175-177]. Subluxations are defined as a self-perpetuating, central segmental motor control problem that involve a joint, such as a vertebral motion segment, that is not moving appropriately, resulting in maladaptive neural plastic changes that interfere with the central nervous system's ability to self-regulate, self-organise, adapt, repair and heal [178]. The logical extension of this philosophy is that correcting subluxations with spinal manipulation is thought to be able to assist with all things that relate to the nervous systems control of the human body. Subsequently students educated in vitalist chiropractic programs are found to believe that spinal manipulation is an effective intervention for AIDS, cancer as well as being a necessary regular lifelong treatment for everybody [24]. The frequent use of *vitalist* language upon which many CPs is structured around is well documented [177, 179]. Similar claims have been found in chiropractors' patient education material and have become a matter for disciplinary action [180]. It is not surprising that for chiropractors of a vitalist persuasion a spinal manipulation would rarely, if ever, be a

non-indication. By those of a mechanistic or EBP persuasion this notion is seen as dogma [181-183] and akin to religious or theological beliefs [184].

This *vitalist* philosophy appears to sit at the heart of 'unorthodox' chiropractic and helps explain the observed inappropriate practices in Canada. Anti-vaccination views in 'unorthodox' practitioners stem from a belief that a fully functioning immune system, free of nerve interference from 'subluxations', will negate the need for immunization [185]. Chiropractic practice is now inhabited by over 200 technique systems that offer a recipe system to detect and / or correct 'subluxations' [186]. Several systems of analysis include the routine use of X-ray as an important ingredient when determining the presence and severity of the 'subluxations' [187, 188]. Finally, the scope of practice appears to be guided by philosophy (any condition that the nervous system can influence) as opposed to only musculoskeletal conditions [24, 189, 190].

At this point in time a 'subluxation' remains a theoretical concept without evidence for its existence or ability to impact on the well-being of patients [191-193]. It is therefore not surprising that the intra and inter-reliability of a practitioners' ability to detect 'subluxations' is little better than chance [181, 194, 195]. It seems incongruous then that one of the graduate competencies listed in the CCE-USA [196] and the CCE-Canada [197] accreditation standards are for students to be able to find and manage 'subluxations'.

The reality of clinical practice is aptly described by the words uncertainty or equipoise. This is exemplified in the case of low back pain, one of the most common ailments humans encounter, where there is considerable difficulty and uncertainty in making diagnoses [17, 198]. This difficulty has resulted in the increasingly widely accepted strategy of recognising the inability to identify the pain generator or aetiology by deferring to the term "non-specific lower back pain" [199]. Regardless of this diagnostic uncertainty, the practitioner is expected to care for patients by applying widely recognised guideline-based interventions [198].

It is logically plausible that IU could be a factor in determining if a chiropractor adopts a 'recipe' solution in order to manage this uncertainty by using a technique system and

/ or a *vitalist* philosophy. In support of this line of thinking, a recent study has found a significant relationship between a person's psychological worldview and anti-vaccination beliefs [200].

Understanding the factors that motivate and sustain these 'unorthodox' practices may inform educators and accreditors on ways to engage with CPs to reduce these type of behaviours.

What should be done?

Chiropractic case management has been studied in France [201] and Sweden [202]. These studies used a methodology which allowed the identification of practitioners who selected inappropriate care. The French study asked chiropractors to choose the appropriate referral options along a continuum of steadily deteriorating scenarios from a simple uncomplicated neck pain through to a situation of a patient with significant neurological findings which warranted immediate specialist referral [201]. Around 12% of practitioners chose medical referral or assistance when it was simple and uncomplicated and 4% of practitioners continued to solo-manage when immediate referral was clearly indicated.

The investigation of Swedish chiropractors choices of care was based around a lower back pain case with 8 scenarios where indications were sought for the practitioners view on the likelihood of the need for on-going or maintenance care [202]. 19% of chiropractors responded to the scenario of a patient with uncomplicated LBP that quickly resolved with the desire to provide on-going maintenance type care without concern for the patient's symptoms during the course of care.

These studies did not look at the reasons behind why chiropractors chose such inappropriate clinical behaviour. This review has led to the contention that personality constructs, such as those described by the FFM and IU, may play a role. Understanding the drivers of clinicians' clinical decisions could inform chiropractic accreditation standards and educators on the development of strategies to improve the quality of chiropractic education. The intention was to recruit a convenience sample of

chiropractic students first for an exploration of hypothesised factors and measures before conducting the larger practitioner study.

Objective:

To this end the following objective was added:

to explore the relationship between various intrinsic factors (such as FFM levels, IU) and signs of unsuitable or unorthodox chiropractic clinical practices, and the clinical decisions in both chiropractic students and practitioners and the consequent implications for CCE accreditation standards and graduate competencies.

Summary

The quality of chiropractic practice has come under increasing scrutiny in the Australian press [203, 204]. A correspondent in the Medical Journal of Australia has called for the sacking of the government appointed Chiropractic Board of Australia because of its inability to take action against chiropractors making false and potentially dangerous health claims [205]. If there was ever a time to use the use the cliché "timely fashion" it would appear to be now for a body of work exploring factors impacting on chiropractic competence.

Significance of study

There are studies in medical education exploring the impact of educational standards prescribed by regulatory or licensing agencies [85, 98-102]. These studies have resulted in a dialogue from which medical programs and regulatory bodies have been able to explore and improve the strengths and weaknesses of the accreditation process [93].

The findings from studies in medical education have shown that the development and revision of clinical or organisational standards require considerable human and financial resources [41]. These studies have raised a number of concerns including; a lack of innovation and transparency of the development [206], lack of stakeholder

[207] and consumer [208] engagement, poor credibility and reliability of new schemes [209], poor reliability of site inspection teams [95, 96], the economic cost [210], the quality of accreditation measures for program assessment [38, 93]. Nonetheless, it has been shown that the health care industry is moving towards constructing the evidence to ground their understanding of accreditation [93].

However, these studies have not been undertaken in accreditation of chiropractic education. This literature review was unable to identify any studies exploring accreditation standards and chiropractic education. It is likely that accreditation of chiropractic programs will experience similar issues to those encountered by medical programs. The evidence from the Canadian 'unorthodox' practitioner characteristics adds weight to this speculation [20]. The identification of such has implications for improvements in efficiency, reliability, validity, and applicability of accreditation for chiropractic education providers. The end result could translate into ensuring patient quality of care and safety as well as international transportability of professionals [45].

Overarching study aim

To explore the role that regulatory (extrinsic) and specific intra-personal (intrinsic) factors may play in the competent practice of chiropractic.

Thesis Outline

To meet these five main objectives this thesis is arranged into nine chapters, written so that each chapter can be read independently. The chapters in this thesis comprise 12 studies on CCE accreditation documentation and the attitudes, beliefs, and personality of chiropractic students and practitioners in relation to their clinical decisions. These 12 studies comprising this thesis are seen as PDF files of the published papers. Consequently, the references for each study are contained within each the reference section of that study. All other references are to be found in the Reference section of the thesis. In summary, the thesis addresses all proposed objectives.

Chapter One is an introduction to the thesis, the objectives and a review of the relevant literature.

Chapter Two seeks to address Objective One by conducting a systematic review of the similarities and differences of graduate entry-level competencies of chiropractic councils on education (CCE) and definitions of competence.

Chapter Three addresses Objective Two by systematically reviewing the similarities and differences of accreditation standards of CCEs. This is split into two studies because of the magnitude of the task. The first study systematically audited how comprehensively evidence-based practice are represented in CCE educational standards, while the second systematically reviewed the remaining accreditation standards. Also, an opportunity arose with the release of the revised CCE-International accreditation standards 2016 standards to compare them to the outgoing 2010 standards for possible emergent trends within chiropractic accreditation. Finally, this chapter concludes with an example of an evidence-based approach to accreditation by designing a questionnaire to measure chiropractic students' perceptions of their undergraduate education.

Chapter Four seeks to answer Objectives Three and Four by systematically reviewing the CCE site inspection standards, processes and reports but could not be conducted because a high rate of refusing to participate.

Chapter Five consists of three cross-sectional student studies derived from two Australian chiropractic programs student population investigating their personality (intolerance of uncertainty), attitudes and beliefs and the relationship to clinical decision making in order to part answer Objective Five.

Chapter Six is a survey of practicing chiropractors that attempts to explore how their personality, attitudes and beliefs related to their clinical decisions and is intended to complete Objective Five.

Chapter Seven is a qualitative study of the views of CCE experts on accreditation bought about by the inability to engage CCEs to quantitatively explore site accreditation in Chapter Four and chiropractic practitioners and their clinical decisions in Chapter Six.

Chapter Eight is an overview of the thesis, and discusses the implications for public safety, quality of chiropractic care, directions for future research and concludes with recommendations to enhance the quality of chiropractic care.

Finally, all the recommendations made in each of the studies in this thesis are collated and presented in Appendix One for greater benefit for the reader.

CHAPTER 2: Systematic review of CCE graduate competencies & definitions of competence.

Attribution

Chapter Two of this thesis is published as

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Stanley Innes co-designed the methods and analyses with the co-authors, analysed the data and contributed to its interpretation, drafted the manuscript, and submitted the manuscript. All authors critically reviewed and approved the final version.

Summary and link to next chapter

Objective One sought to compare CCE definitions of competency and their graduating chiropractic student competency lists. To this end the first study systematically reviewed the five CCEs definitions of competence and expectations for the competencies required for a graduating chiropractic student. The intent was to obtain a richer understanding of the language comprising the standards expected of CPs students to attain prior to graduation. It was published in the prominent chiropractic professional journal Chiropractic and Manual Therapies.

This revealed that CCEs did not share a common understanding of the word "competency" when describing the practice of chiropractic. Nor did they share a common structure for describing the required knowledge, skills, attributes and abilities. In addition, the domains for competencies were constructed in accord with the chronological order of the clinical encounter. This was at variance with widely respected medical models that focused on the various roles of a practitioner. The tabulation and comparison process revealed that there were more similarities than differences in graduating competencies. Differences were due to varying levels of prescriptiveness for the competency. Of concern was that two CCEs included the expectation of being able to examine a "*subluxation*", a theorized but not validated spinal dysfunction, thought to influence pain and other non-musculoskeletal conditions.

The identification of competencies with varying levels of expectations allowed the construction of a table of recommendations to create a homogeneous, internationally consistent, and high-quality set of graduating competency standards. For greater utility, all tables of recommendations are also found in Appendix 2.

Study: Similarities and differences of graduate entry-level competencies of CCEs.

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SYSTEMATIC REVIEW Open Access

Similarities and differences of graduate entry-level competencies of chiropractic councils on education: a systematic review

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Abstract

Background: Councils of Chiropractic Education (CCE) indirectly influence patient care and safety through their role of ensuring the standards of training delivered by chiropractic educational institutions. This is achieved by CCEs defining competence and creating lists of descriptive statements to establish the necessary standards for students to attain before graduating. A preliminary review suggested that these definitions and descriptive lists lacked consensus. This creates the potential for variations in standards between the CCE jurisdictions and may compromise patient care and safety and also inter-jurisdictional mutual recognition. The purposes of this study were 1) to investigate similarities and differences between the CCEs in their definitions of competence, domains of educational competencies, components of the domains of competencies, as represented by assessment and diagnosis, ethics, intellectual development, and 2) to make recommendations, if significant deficiencies were found.

Method: We undertook a systematic review of the similarities and differences between various CCEs definitions of competence and the descriptive lists of educational competencies they have adopted. CCEs were selected on the basis of WHO recommendations. Blinded investigators selected the data from CCE websites and direct contact with CCEs. This information was tabulated for a comparative analysis.

Results: All CCEs' definitions of competence included the elements of "knowledge", "skills" and "attitudes" whereas only one CCE included the expected "abilities" element. The educational application of the definition of competency among CCEs varied. A high level of similarity when comparing the domains of competence adopted by CCEs was found despite variations in the structure.
Differences between CCEs became increasingly apparent when the three selected representative domains were compared. CCEs were found to stipulate varying levels of prescriptiveness for graduate entry level standards.

Conclusions: A series of recommendations are proposed to create uniform and high quality international standards of care. Future research should compare the levels of CCEs enforcement of standards to see if similarities and differences exist.

Keywords: Councils of chiropractic education, Competence, Practice profiles, Standards of education, Similarities, Differences

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Introduction

Chiropractors are trained worldwide in different types of institutions; most are private colleges but some are integrated into state funded universities. Accreditation authorities ensure that there are professional standards that must be met in chiropractic pre-professional training so that patients are protected and treated properly by graduates from those programs. These accreditation authorities are usually empowered or accredited to do this by their respective governments. In this way individual colleges do not have full power to determine their own course criteria. For chiropractic educational institution standards this control mechanism of course accreditation is carried out by various Chiropractic Councils of Education (CCE). These CCEs are located in North America, Australia, Canada, and Europe. There is also an international umbrella council of chiropractic education organization known as the Chiropractic Council of Education International (CCE-Int) [1]. The World Health Organization (WHO) recommends the CCE-Int as the consultative body for national health authorities when evaluating chiropractic training programs [2].

Educational standards of the various institutions are defined and monitored by the CCEs which enforce this by inspecting and evaluating the chiropractic institutions' facilities and educational programs. CCEs achieve this, in part, by defining competence and creating lists of descriptive statements to clarify the necessary knowledge, understanding, skills, attitudes, and behaviours students should attain before graduating and entering practice [3]. These competencies are an important means by which regulatory bodies can change professional standards of practice [4].

Defining Competency

The conceptualisation of competence has important implications for the way that competence based medical education is implemented [5]. The Oxford Concise Dictionary defines competence as "the ability to do something successfully or efficiently" [6]. However, it has been suggested that one broad definition is not suitable for all professions [7] and what is required are specific definitions and competencies that have sufficient detail and clarity to be professionally useful [8].

Efforts to make the use of competencies more profession specific and effective increased in the 1960s as companies sought to assess an individual's expected performance levels, skills and knowledge [9]. Today competencies are extensively applied to describe expectations of graduating students in medical and allied health professions [3]. This level of specificity is required to detail the domains for the practitioner to function successfully within that discipline. For this reason it is appropriate for CCEs to define and prescribe these domains and their components which are required to produce competent chiropractic clinicians. This process should result in a high standard of chiropractic education at internationally comparable levels [10].

There is not a universally agreed conceptualisation of competence in medical education. A systematic review of medical definitions of competence, concluded that the words "knowledge, skills and other" were the most commonly occurring components [5] The authors allocated all other words to a general category "other components". Here, "attitudes" and "abilities" were prevalent and also suggested as essential ingredients of competence. "Skills" were defined as being related to manual dexterity while "ability" seen to be was commonly composed of abstract reasoning, memory and the cognitive processes associated with solving novel questions.

Problem

There is evidence of variations in practitioner profiles [11] as seen in a recent study of Canadian chiropractors that showed differences in vaccination beliefs, X-ray usage, referral patterns, and treatment types, some of which must be considered unsuitable. These unsuitable profiles were found to be stemming from a cluster of accredited educational institutions in North America [12]. Another Canadian study found a relationship between the accredited educational institution of graduation and chiropractors' interactions with other health professionals, as measured by receiving patient referrals from medical doctors [13]. The chiropractors less likely to receive referrals were more likely to take their own radiographs, treat a higher percentage of patients for somatovisceral conditions and consider maintenance/wellness care as a main component of practice activity. These findings support the possibility that there are differing standards of CCE requirements resulting in differing graduate outcomes.

This may be the case because laws and scope of practice may differ on a country-by-country basis. Thus, a CCE for a regional part of the world may reflect those differences as a result of scope. Another possible explanation, which may account in part for these differences are differing standards of the various CCEs because of contextual independence and in selections of definitions of competence. This may result in differences in standards between jurisdictions perhaps resulting in dissimilarities in practitioner profiles. There is evidence that this is the case for medicine [14, 15].

Some practice profiles are clearly undesirable. For example, information obtained from the Chiropractic Board of Australia [16], Wisconsin Chiropractic Examining Board [17], and previous research [18] suggests that the competency domains of 1) patient assessment and diagnosis, 2) ethics, and 3) intellectual and professional

development are matters that commonly appear in registration or licensing board complaint investigations. Consequently, analysis of similarities and differences in these three key domains between all CCEs is important when looking for differences in standards that may result in desirable or undesirable practice profiles and uniformity of standards worldwide.

In summary, the literature confirms that competence is not uniformly conceptualised in health education. Similarities and differences exist between and within professions [5] and educational competencies used to describe high standards of practice, need to be profession specific. Variations between the definitions of the different CCEs and prescriptive lists describing competency may result in differing practitioner profiles, which may create differences in the quality of care and patient safety. Ultimately, an unequal standard and overly varied treatment approach may also impact on the international mobility of chiropractors.

Aim

The aim of this systematic review was to investigate similarities and differences between the various CCEs in their definitions of graduate competency and the educational competencies they have adopted.

Objectives

The objectives were to review: 1. CCE definitions of competence; 2. domains of educational competencies; 3. components of the domains of competencies, as represented by assessment and diagnosis, ethics, and intellectual development, and 4. to make recommendations, if significant deficiencies were found.

Method

We conducted a systematic review to investigate the first three objectives. Protocols for clinical systematic reviews are recommended to be prospectively registered where possible (PRISMA [19, 20] PROSPERO [20]), However, as this systematic review focussed on the descriptive definitions in documents obtained from CCEs used for educational standards for chiropractic competence and not peer reviewed journal articles, it was not eligible for prospective registration with databases such as PROSPERO [21].

Eligibility criteria

The WHO recommends the CCE-Int as the source of information regarding evaluation of chiropractic education [2]. Consequently, for CCE inclusion, we used this recommendation meaning that a CCE used in our study had to be recognized by the CCE-Int and be a member in good standing. The Council on Chiropractic Education (CCE-USA), Council on Chiropractic Education Australasia (CCE-Australia), European Council on Chiropractic Education (ECCE), and Council on Chiropractic Education Canada (CCE-Canada) all met the inclusion criteria.

Data extraction process and synthesis of results

The respective CCE websites were identified and searched independently by the lead author and a research assistant. All CCEs were asked in writing whether additional relevant information was available that was not available on their respective websites.

A Masters in Business Administration graduate experienced with organisational evaluation acted as a research assistant and was instructed on the search domains. A training exercise was undertaken to establish a consistent process for extracting data from the websites. The research assistant was instructed on the aims and objectives of the project. Further, the roles of the CCEs were defined. The independent reviewer conducted a web search to locate the CCEs. The lead author and the research assistant then independently searched the CCE websites to identify and extract a definition of competence. The extracted data was recorded and tabulated. The author and research assistant then compared these for agreement. A third investigator was available to resolve any conflicts. The table format for the definitions was structured to identify similarities and differences with respect to the elements of "knowledge", "skills", "abilities", "other components", and "profession specific details".

The same process was repeated for the extraction of competency lists for each CCE.

Finally, the components of the three selected domains (professional and intellectual development, assessment and diagnosis, ethics and jurisprudence,) were extracted and placed into a tabular format and analysed for similarities and differences (Fig. 1).

The CCE definition of competence informs the comprehension and construction of undergraduate competencies. Competence is deconstructed into a series of domains thought to describe chiropractic practice. Each of these domains is further deconstructed into smaller subdomains and finally components which are intended to be measureable behaviours and outcomes.

Results

The research assistant and lead author (SI) extractions agreed on 4 of the 5 definitions of competence. After discussion consensus was reached on the one CCE definition mismatch and did not require independent adjudication. There was agreement between both researcher and research assistant on all 4 of the CCE lists of competency. This resulted in a match on 8 of the 9 data extractions.

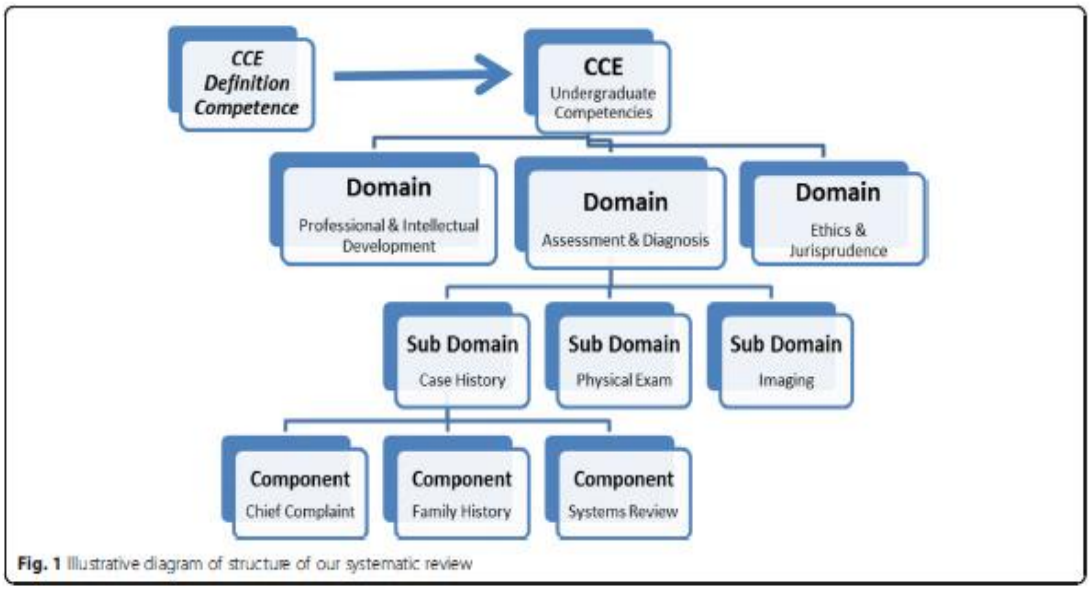

Fig. 1 Illustrative diagram of structure of our systematic review

The CCE-Int and the four regional CCEs (CCE-USA, CCE-Aust, CCE-Canada, ECCE) were included for the first objective of comparing competency definitions. The CCE-Int did not have any graduate entry-level standards for competency and could not be included in the analysis for the second and third objectives.

All CCEs responded to the request asking about the presence of additional information apart from their websites, and all stated that there was no additional information.

The investigators agreed on all definitions and competency selections from the respective CCE websites.

The ratios of CCE domains and components of domains were found to vary considerably. The largest was found for the CCE-Aust which had 11 domains with 299 components describing these domains (Table 1), resulting in a ratio of 27.2 components per domain. The smallest was noted for the ECCE with 3 domains and 21 components (i.e. a ratio of 7.0).

Objective 1: definitions of competency

All the CCEs used definitions of competence that included two of the three basic elements, namely *knowledge* and *skills*. Another word common to all five CCEs was *attributes* (See Table 2). Only the ECCE included the expected third element of *abilities* and this was used with respect to problem solving.

Three CCEs included words from the "other components" category. First, the CCE-Int definition specified that the skills necessary for the competent practice of chiropractic are psychomotor in nature, and that these should become "*habits*". Second, the ECCE added "*problem solving abilities and attitudes*". Third, the CCE-USA used the term "*meta-competencies*".

The CCEs did not have a common function or context for application of the definition of competency. The CCE-Canada described the use of competencies as a feedback mechanism for "*monitoring the educational progression toward becoming a chiropractor*". The CCE-Aust and the CCE-USA definitions were used to determine if a student was ready to graduate and enter solo practice. The ECCE applied the definition to "*controlled representations of professional practice while performing at maximum levels of ability*".

Table 1 Number of domains and component statements and ratios of these among the CCEs

	CCE-Aust	CCE-Canada	ECCE	CCE-USA
Domains	11	14	3	7
Component statements	299	213	21	63
Component/Domain ratio	27.2	15.2	7.0	9.0

Objective 2: domains of competency

There was inconsistency in structure among the CCEs for domains of competency and this affected the methodology for data extraction. For example, the CCE-USA had only 7 areas or domains but the CCE-Canada had the greatest number with 14. Consequently the CCE-Canada domains were chosen as the basis for the table structure of comparative purposes because it included all the available information found in the other CCEs and would therefore enable the identification of apparently absent domains. These 14 domains of competency were presented in Table 3.

Table 2 Definitions of competency used by the major regulatory bodies

Name of CCE	Definition of "competency"	Knowledge	Skills	Attitudes	Context	Other
CCE-Int	the practice of chiropractic requires the acquisition of *relevant knowledge, understandings, attitudes, habits and psychomotor skills* (pg 3, 2010)	X	X	X	Practice of chiropractic	Habits
CCE-Aust	Competencies: Written statements describing the levels of knowledge, skills and attitudes expected of graduates (pg 18, 2009).	X	X	X	practitioner	
ECC-Europe	a measurable set of *skills, knowledge, problem solving abilities and attitudes* in controlled representations of professional practice when performing at maximum levels of ability (pg 57, 2013).	X	X	X	Professional practice	Problem solving abilities
CCE-Canada	a student's *knowledge, skills and attitudes* with the goals of providing feedback to enhance the educational progress, rating performance, and determining the appropriateness of progression in the clinical phase of becoming a qualified chiropractor (pg 68, 2011).	X	X	X	Qualified chiropractor	
CCE (USA)	Mandatory meta-competencies have been identified regarding the *skills, attitudes, and knowledge* that a doctor of chiropractic program provides so that graduates will be prepared to serve as primary care chiropractic physicians (pg 21, 2013)	X	X	X	Chiropractic physician	
Aust. National Health Work Force	It refers to specific capabilities in applying particular *knowledge, skills, decision-making attributes and values* to perform tasks safely and effectively in a specific health workforce role (pg 5, 2011)	X	X		Health workforce role	Values, decision making attributes

Table 3 Comparison of common competency domains of CCEs

Major elements/ domains of competency	CCE-USA	CCE-Aust	ECC-Europe	CCE-Canada
History taking	X	X	X	X
Physical exam	X	X	X	X
Neuromusculoskeletal exam		X		X
Psychosocial assessment + cultural gender ethnic diversities		X	X	X
Diagnostic studies- interpret clinical laboratory findings and diagnostic imaging of NMSK	X	X	X	X
Diagnosis & differential diagnosis	X	X	X	X
Case management/Referral	X	X	X	X
Chiropractic adjustment or manipulation skill, competent care	X	X	X	X
Emergency care		X		X
Case follow-up and review	X	X		X
Record keeping	X	X		X
Doctor-patient relationship/communication	X	X	X	X
Professional issues/continuing education/Sound business practice/ethical practice	X	X	X	X
Other therapeutic procedures	X	X	X	X
Public health and community interaction*	X	X	X	
Health care system interaction*		X	X	
Professional interaction*	X	X	X	
Staff and financial management*		X		
Information and technology**	X			

Indicates domains from other than CCE-Canada* CCEA** CCE-USA

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ECC-Europe	a measurable set of *skills, knowledge, problem solving abilities and attitudes* in controlled representations of professional practice when performing at maximum levels of ability (pg 57, 2013).	X	X	X	Professional practice	Problem solving abilities
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Diagnosis & differential diagnosis	X	X	X	X
Case management/Referral	X	X	X	X
Chiropractic adjustment or manipulation skill, competent care	X	X	X	X
Emergency care		X		X
Case follow-up and review	X	X		X
Record keeping	X	X		X
Doctor-patient relationship/communication	X	X	X	X
Professional issues/continuing education/Sound business practice/ethical practice	X	X	X	X
Other therapeutic procedures	X	X	X	X
Public health and community interaction*	X	X	X	
Health care system interaction*		X	X	
Professional interaction*	X	X	X	
Staff and financial management*		X		
Information and technology**	X			

Indicates domains from other than CCE-Canada* CCEA** CCE-USA

Despite the differing structures, there was considerable agreement among CCEs. All stipulated that competence required the domains of history taking, physical examination, differential diagnosis, imaging, laboratory testing, chiropractic adjustment/manipulation skill, management, delivery of care and communication. Finally, competency was expected in the domains of 'professional issues', 'continuing education', 'sound business and ethical practice', 'public health', and 'community and professional interaction'.

Despite high similarity levels, also differences were noted. The same terms or phrases describing competencies were found at the domain or subdomain level in different CCEs. For example the CCE-Canada and CCE-Aust included competence in dealing with an emergency medical situation while assessing or providing care. The ECCE and CCE-USA included it at the subdomain level. The CCE-USA did not state the need for a psychosocial assessment at the domain (metacognitive) level; rather it was presented as a component of the domain of assessment and diagnosis.

Some CCEs had unique domains. The CCE-Aust specified the area of staff and financial management and the CCE-USA required competence with information and technology.

The only notable omission was that the ECCE did not state the need for case follow up or review and did not specifically mention competent record keeping.

Objective 3: analysis of three important domains

All components of the three selected domains of 'assessment and diagnosis', 'professional ethics and jurisprudence', and 'intellectual and professional development', were tabulated and presented in Table 4.

First domain - assessment and diagnosis

This domain was described using a number of subarea statements. Two of the CCEs (Europe and Canada) expected that assessment and diagnosis would be underpinned by background knowledge of clinical science. They stated that this should be evidenced by an understanding of the pathophysiology, history and signs and symptoms of neuromusculoskeletal conditions. Only the CCE-Canada included prognosis of musculoskeletal conditions. The CCE-USA and CCE-Australia made no mention of clinical science competence. CCEs described "Assessment and Diagnosis" by breaking it down into smaller components. These tended to *case history, physical examination, investigations/laboratory testing/imaging, and diagnosis*.

Case history

All CCEs used the term "case history" when describing assessment and diagnosis. However they differed in the number of components they used to define it. The CCE-Aust used the word *"comprehensive"* to define the taking of a case history. The remaining CCEs stated it need not be comprehensive but could be problem focused or case appropriate. Two of the CCEs (CCE-USA and CCE-Canada) defined the components of a case history as being a chief complaint, a systems review, and family history while the others did not.

The CCE-Aust and the CCE-Canada stated the need for consideration of patient comfort (physical and psychological) and a display of empathy (verbal and non-verbal) during history taking whereas the CCE-USA and ECCE did not.

Physical examination

There was an expectation of a physical examination by all CCEs but the difference in the number of descriptive statements was considerable.

The ECCE simply asked for *"an appropriate physical examination for the purpose of arriving at an appropriate diagnosis"*. The CCE-USA described it as *"performing case appropriate physical examinations that include evaluations of body regions, organ systems including the spine and any subluxation/neuro-biomechanical dysfunction . . for developing the clinical diagnosis"*. The CCE-Canada was the only other CCE to use the word subluxation in this context, defining it as being an "articular subluxation".

The CCE-Aust and CCE-Canada were more prescriptive. They viewed this domain as comprising two components; a general physical examination (15 descriptive statements by the CCE-Aust and 16 by the CCE-Canada) and a neuro-musculoskeletal examination (6 and 14 statements, respectively). Consequently they were able to include issues such as a patient-centred approach to physical examination, the reliability and appropriateness of examination procedures and findings, and an explanation of these to the patient. Only the CCE-Canada required practitioner hygiene and patient safety considerations during a physical examination.

The ECCE and CCE-USA stated that a physical examination is to be used to formulate a diagnosis. The CCEs of Australia and Canada expanded this purpose so that the physical examination was also required to evaluate the patient's clinical status, monitor change, and rate disability and impairment.

Investigations/laboratory tests/imaging

All CCEs expected competent interpretation and appropriate use of laboratory tests. Competency interpreting advanced imaging (such as MRI, CAT scans or musculoskeletal ultrasound) was not specified by any CCE.

The CCE-USA statement with regard to diagnostic competency was: *"utilizing diagnostic studies and consultations,*

Table 4 Descriptions used by CCEs of the three selected representative domains of "assessment & diagnosis", "professional jurisprudence and ethics" & "intellectual and professional development"

Competency dimension :assessment and diagnosis	CCE-USA	CCE-Aust	ECC-Europe	CCE-Canada
Background clinical sciences				
Understand the pathophysiology and history of NMSK conditions			X	X
Understand the signs and symptoms of NMSK conditions			X	X
Understand the prognosis of NMSK conditions			X	
Case history				
Data gathering (CCE USA)	X	X	X	X
Data recoding	X	X	X	X
Take a comprehensive problem-focused or case-appropriate history	X	X	X	X
Psychosocial factors considered in case history taking	X	X	X	X
Cultural ethnic issues considered specific to case history taking		X	X	X
Patient centred/comfort when history taking		X	X	X
History taking subcomponents specified eg chief complaint, family, past, systems review	X		X	
Practitioner behaviours describe during the process		X		X
Physical exam/assessment				
Perform an appropriate general physical exam	X	X	X	X
Perform an appropriate case appropriate/NMSK physical exam	X	X	X	X
Description of physical exam components				X
Incorporate psychosocial assessment	X	X	X	X
Incorporate subluxation/neuro-biomechanical dysfunction	X	X		X
Reliability of data/tests/ examinations considered		X		X
Patient-centered requirement, comfort, respect + psychosocial factors assessment		X	X	X
Doctor hygiene and patient safety				X
Explanation of findings to patient		X		X
Radiology – with specific requirements				
Radiological Interpretation		X		X
Radiographic technology		X		X
Laboratory tests				
General statement for requirement of utilization & interpretation competence	X	X	X	X
Risk/cost benefit analysis		X	X	X
Within scope of practice		X	X	X
Ordered based on previously obtained clinical data		X		X
Explained to patient		X	X	X
Diagnosis				
Formulate a diagnosis(es) based on information gathered-general statement	X	X	X	X
Documentation of diagnosis	X	X		X
All material considered in the diagnosis	X	X	X	X
Use diagnosis for recognition of when condition exceeds capacity/ referral		X	X	X
Explanation of diagnosis to patient		X	X	X
Within the context of clinical reasoning skills/problem-solving skills	X	X	X	X

Table 4 Descriptions used by CCEs of the three selected representative domains of "assessment & diagnosis", "professional jurisprudence and ethics" & "intellectual and professional development" *(Continued)*

Competency dimension : professional ethics and jurisprudence	CCE-USA	CCE-Aust	ECC-Europe	CCE-Canada
Ethical principles & professional conduct	X	X	X	X
Patient – practitioner boundaries: physical, communication (verbal, non-verbal) emotional	X	X		X
Knowledge of health care law	X	X		X
Professional conduct with peers	X	X	X	X
Professional conduct with patients	X	X	X	X
Professional conduct with staff	X	X		X
Compliance with ethical and legal dimensions	X	X	X	
Patient records and patient billing meets state and federal law	X	X		X
Ethical business practices		X		X
Professional participation/support		X		X
Explain the importance of research participation		X		X
Competency dimension : intellectual and professional development	CCE-USA	CCE-Aust	ECC-Europe	CCE-Canada
Seeking and application of new knowledge	X	X	X	X
Ability to adapt to change	X	X	X	X
Critical appraise literature and apply it to clinical practice/patient care	X	X	X	X
Understanding of research methods and significance in modern health care	X	X	X	X
Provide evidence of critical thinking skills	X	X	X	X
Reflect on personal and professional learning skills	X	X	X	
Application into patient care	X	X	X	X
Demonstration of basic, social and clinical sciences sufficient to promote intellectual development and effective patient care	X			

where appropriate, inclusive of imaging, clinical laboratory, and specialized testing procedures, to obtain objective data". Unlike the other CCEs it did not specify the need for consideration of risk/cost benefit when ordering laboratory tests or imaging. It also permitted a chiropractor to order a test for any condition rather than those related to neuromusculoskeletal issues. This may be a reflection of a broader scope of practice available to USA chiropractors. Further there was no requirement to explain the findings to the patient.

The ECCE stated that the chiropractor should be able to "*interpret diagnostic procedures ...and their uses and limitations . . .*" whereas, again, the CCEs of Australia and Canada were more prescriptive. The CCE-Aust had 25 descriptive statements (11 for radiographic interpretation and 14 for radiographic technology) and included items such as "*radiographic data being used to confirm the accuracy of the presumptive diagnosis initially identified . . . . each radiograph is thoroughly scrutinised in an organised manner...adequate patient protection is used... exposure technique uses safety parameters*". The CCE-Canada stated: "*...understands the principles, applications, technical and procedural elements of equipment employed in diagnostic imaging . . . . . take, process and interpret plain film radiographs with appropriate attention given to quality and safety".*

Diagnosis

There was global agreement with the need for a competent chiropractor to be able to gather, document and analyse patient information, refer to others (if indicated) and arrive at a list of differential diagnoses. All CCEs recognized the need for an overarching competence in clinical reasoning/problem-solving skills. The CCE-USA was the only one that did not require communication of these findings to the patient. The ECCE made no statement on the need for appropriate or adequate documentation or clinical records.

Domain 2: professional ethics and jurisprudence

All CCEs expected that the chiropractor should behave in an appropriate ethical and professional manner. This involved appropriate conduct/communication with peers and other health care providers.

The CCEs used different terms to describe the context and application of ethical and professional behaviour.

The CCE expectations were: for this performance to occur at the highest possible levels (ECCE), that chiropractors exhibit this behaviour (CCE-Canada), that it is complied with and maintained (CCE-USA), and that graduates are expected to be aware of professionalism and display it (CCE-Aust).

Some differences were noted. The CCE-Canada stipulated that ethical practice should include ethical business practices while the CCE-Aust expected subscription to the professions code of ethics and adherence to the legal requirements of conducting a practice. The CCE-USA specified ethical business standards as including the meeting of legal requirements for patient records and billing codes, and professional conduct with staff in accordance with established policies. All, except the ECCE, stated that they expected professional conduct with staff. Finally, neither the ECCE nor the CCE-Aust mentioned the need for patient-practitioner boundaries whereas the others did.

The CCE-Canada and the CCE-Aust required the competent practitioner to support and participate in professional activities, although this was not defined. They both also expected active knowledge of research and its use for the profession. The CCE-USA and the ECCE wanted the individual practitioner to have knowledge of research methodologies and the ability to critically appraise scientific literature and incorporate this into patient care. The ECCE additionally stated the need for contribution to the generation of knowledge and the education of junior colleagues.

Domain 3: intellectual and professional development

All CCEs described the competent practitioner as one who seeks new knowledge, critically evaluates it and would apply new knowledge to patient care over the duration of their professional lives. Further, all CCEs expected an understanding of research methods and its significance in modern health care. Additionally, all CCEs expected competency in critical thinking to evaluate current and new knowledge. The term "evidence-based" was generally absent, only used by the ECCE.

Some minor differences were noted. The CCE-USA alone expected an ability to reflect on personal and professional learning skills. The CCE-Aust specified activities for professional scientific development such as the ability to give a case presentation with an adequate review of the literature.

Discussion

This review appears to be the first systematic approach to investigate similarities and differences between definitions of competency and graduate competency standards of the various CCEs. In general these definitions were more similar than dissimilar. There was considerable agreement in the choice of definitions for competency and the content at the domain level describing it. However, there was discernible variation in the degree of prescriptiveness of the CCEs when describing competency standards. Meaningful differences became increasingly evident when comparing the component lists describing the domains. In a worst case scenario such differences could result in incompetent emergency care, inadequate case history and physical examinations, inappropriate radiological utilization, and poor comprehension of patient-practitioner boundaries.

Definitions of competence

CCEs were found to be similar to medical councils on education as they both included "*knowledge*" and "*skills*" as important elements when defining competence [5]. Unlike medical councils on education, all CCEs included "attitudes" but only one included "abilities". While this may be due to differences in the understanding of the words used by CCEs, it speaks to the need for agreement between CCEs on the definition of common words used in their documentation.

However, a health practitioner's attitudes and knowledge may not reflect his/her actual behaviour [22]. By including the element "abilities" in definitions, it would be possible to measure a greater range of behaviours, which in turn would make them more professionally specific and useful for assessment purposes [8]. The CCEs were dissimilar with respect to the additional elements they included in their definitions when compared to medical councils on education definitions of competence. There were only two; psychomotor skills and problem solving abilities. The medical education literature recognises a much broader understanding of additional elements [5]. This includes, but is not limited to, communication, assessment, collaboration, and advocacy. These, along with problem solving are seen as important underlying factors for medical graduate competency lists [23]. Also chiropractic practice requires these dimensions as well as manual skills and abilities. Consideration on how to address all these dimensions in CCE definitions would add to their clinical usability.

The purposes of the CCE definitions were either to monitor students' progress or to determine if they were ready to serve as a chiropractor. Assessing a student at a fixed point in time, such as at a competency exam before graduation, may be a poor moment for monitoring progress. The determination of a student's competence development also requires the capacity to inform the educators how effective a curriculum is in producing a graduate with desired qualities for the profession [24]. Non chiropractic examples, such as reported in the recent review of Australian health-force competency-based education, included the basic elements of knowledge,

skills, decision making attributes and values when assessing the students' preparedness for graduation. However these were applied to "*performing tasks safely and effectively in a specific health workforce role*" [25]. A definition such as this, with safety as a central issue, may create opportunities for more specific and effective graduate competencies and improve its applicability for chiropractic students and graduates. Alternatively, one specific definition may be required for monitoring students' progress and another for determining whether or not they are competent for graduation and solo practice.

In sum, knowledge, skills, and attitudes are common components of definitions of chiropractic competence. Nevertheless, further work is needed to clarify other useful profession-specific dimensions such as the types of abilities and skills required and the time at which they should be assessed.

Domain analysis

Despite the considerable variability in the number of domains, a high degree of content similarity was found at this level between the CCEs.

CCE regulations were similar in the approach they took to constructing domains. They tended to fragment the clinical encounter chronologically i.e., case history, assessment, diagnosis, and case management. Recent medical trends have moved away from this thinking and have constructed domains that encompass overarching aspects of practice. For example, the Canadian system of CanMEDS describes these in terms of roles such as medical expert, communicator, collaborator, scholar, health advocate and professional [26]. The American medical system, as exemplified by the Accreditation Council for Graduate Medical Education, ACGME, [27], utilises the domains of patient care, medical knowledge, practice based learning and improvement, professionalism and interpersonal skills, and communication [27]. These approaches have been well funded, developed by eminent physicians and academics, and are built on extensive clinical experience and the highest quality evidence. As such they deserve serious consideration for their applicability and relevance also to chiropractic education. This would allow chiropractic educators access to researched and validated medical education changes based on this structure which will in turn improve educational outcomes. Indeed, past research has suggested that European chiropractic students and practitioners consider the 7 domains of CanMEDS as being important and highly applicable to chiropractic graduate training [28].

Component analysis of three representative domains

The domain structures among CCEs were sufficiently similar to allow identification for comparison purposes. However, it was apparent that CCEs had used differing levels of prescriptiveness, when describing these.

The first difference noted was that two CCEs included an expectation of 'fundamental knowledge of pathophysiology' and the remaining did not. One possible explanation is that it could be assumed that there would be enough knowledge underpinning other components and that it does not require stipulation. For example, pathophysiology is required to competently construct a differential diagnosis. Its absence would be indicated by inadequate diagnostic skills, which is a stated expectation among all CCEs. Nonetheless consideration should be given to the clear stipulation of the knowledge expected of chiropractic graduates relevant to CCE competencies. This would improve the educational institutions' ability to understand and meet the CCE graduate expectations.

In general, there were demonstrated differences in the prescriptive approaches taken by the CCEs. This was exemplified in the contrasting standards for radiographic imaging of the CCE-Canada and CCE-USA. Historically, chiropractic treatment systems have been documented to overuse radiography [29–31]. Reasons for this have included diagnostic uncertainty, fears of missing contraindications to manipulation, financial gain, routine screenings, and biomechanical considerations [29, 32]. The CCE-USA radiographic/imaging requirements were minimal and did not possess the detail to specifically address many of the reasons for radiography overuse. However, the CCE-Canada imaging related statements contained more detail thus specifically addressing appropriate levels of use. This difference between the two CCEs may provide a possible mechanism for the existence of practitioner variations found in X-ray utilisation in the Canadian practice profiles, as referred to in our introduction [13]. Further, all CCEs need to include more competency expectations for contemporary imaging modalities.

While all CCEs may be similar in the use of certain words or terms they were sometimes dissimilar in the way they understood that word and in how they intended it to be applied to clinical practice. For example, all of the CCEs utilized the term "physical examination". The descriptive terms CCEs used to describe it ranged from performing an "appropriate physical examination .....to arrive at a diagnosis" through to a more prescriptive approach of conducting a complete physical and targeted neuro-musculoskeletal examination. The more prescriptive approach specified the exam procedures and their function as a means of developing a diagnosis, rating disability and impairment, and for monitoring patient change. The dissimilar approach was also seen with the various terms used to describe the focus of the examination such as "*subluxations*"

"articular subluxation" and *"neurologic and orthopaedic dysfunction"*. Recent research has suggested that 63 % of medical errors were a result of failure to perform a physical examination [33]. As a consequence of physical examination inadequacy, 76 % of cases included a missed or delayed diagnosis and 18 % received incorrect treatment. This suggests that CCEs should consider the evidence for a more prescriptive approach to the components of a physical examination to reduce the possibility of errors. Further there is a need for a clear understanding of how the physical examination relates to chiropractic practice. The terms currently used, such as "subluxation" are not reproducible clinically diagnosable entities [34]. This is further complicated by the general difficulty in arriving at a diagnosis for commonly encountered chiropractic conditions, such as low back pain [35]. An evidence-based approach to these clinical uncertainties has been proffered and warrants consideration [36].

The domain and the descriptive statements for *Intellectual and professional development* were very similar among CCEs. Competent graduates were expected to be lifelong learners who could critically evaluate and apply new and existing knowledge. Only one CCE used the widely accepted and commonly used medical education term of an evidence-based approach, when describing this domain [37]. There is substantive research surrounding this approach to learning and professional development [38]. Recent research found that 46 % of USA chiropractors did not take evidence-based practice into account when making clinical decisions [39]. However, this study found that 85 % of these respondents were interested in improving their skills necessary to incorporate it into their practices. This would suggest that further emphasis by CCEs may be required to continue to promote evidence-based practice.

Its use in chiropractic competency lists may be part of that process. Further, using a common language may improve communication between health educational bodies and integration within the health field [40]. Consequently, consideration should be given to wider use of the term "evidence-based" in graduate competencies among CCEs.

While all CCEs were similar in the recognition of a domain for ethical and professional behaviour, they were dissimilar in the description of its expression in practice. They varied from expecting it to occur at the "highest possible levels" through to being "aware of it". Ethics education in North America and Canadian Chiropractic colleges appears to be very diverse with variable content and no common reference reading materials [41]. Of concern is that variations in chiropractic course content may result in some important ethical areas being omitted. For example, this review found that only two of the four councils on chiropractic education made specific reference to the need for patient practitioner boundaries. Several solutions have been suggested. One is a broader based and more congruent undergraduate ethics curriculum [41]. This would also have the additional benefit of increasing the trend of chiropractic integration into mainstream health care settings [41]. Another recommendation could be to increase chiropractic education and training in the area of practitioner behaviour [42]. The presence of these recommended changes in competency standards would give chiropractic educational programs guidance on course content and warrants serious consideration for inclusion.

Differences in the wording of ethical business practice description lists were noted among CCEs. These varied from a general expectation of conducting ethical and legal business standards to the meeting of the legal requirements for patient records and billing codes. There are known issues in chiropractic practice such as unsubstantiated claims in patient brochures [43], wellness practice based on "vitalism" tenets [44], the sale of "good health" products [45], and anti-immunization views [12] which are not addressed by the current descriptive lists by all CCEs. However the descriptive list from *intellectual development* which expects the practitioner to know and apply current knowledge, if enforced, should theoretically restrict these behaviours.

Of course, other mechanisms may account for these aberrant practice behaviours that develop after graduation other than insufficiently detailed CCE competencies. While one explanation could be that CCEs in certain geographical locations may not be enforcing these standards. Other factors may also be post-graduation practice expectations from work colleagues, practitioner personality types, and adoption of a chiropractic technique which are at odds with these regulatory competencies.

In sum, CCEs take varying approaches to the task of constructing graduate entry-level standards. A less prescriptive approach is typified by general guidelines and discretion appears to be given to the educational institutions to interpret and implement them. This creates the capacity for innovative teaching and practice. The opposite may be viewed as a more directive or prescriptive approach. While this reduces the potential for innovative teaching styles, it also reduces the capacity for deviation and potentially irregular practice profiles.

Recommendations

This review has sought to identify similarities and differences between CCEs internationally in their

definitions of competence and graduate entry level competencies. This has led to the identification of a number of issues and, based on these, we make a number of recommendations that are summarised in Table 5. If these recommendations were adopted then outcomes such as a uniform high standard of practitioners who are evidence-based and lifelong learners is likely across all CCE-controlled regions. This would ensure and safeguard the international trust in practitioners' ability to deliver ethical, safe and quality care across international borders.

Methods/Considerations

A potential weakness of this study is the subjective nature of the interpretation of the structure for the analysis of the domain and component statements. Our choice of domains may differ from others. For example we selected for convenience the 14 domains of CCE-Canada as a comparative analyses structure. There may be other possible constructions for analysis which may impact on the differences and similarities observed.

The strengths of this review are that it did take a systematic approach and that the two investigators

Table 5 Summary table of recommendations

	Recommendations in relation to competencies	Justifications
1	An internationally uniform definition of competence for chiropractic education and assessment is required. This may require agreement from all CCEs on the definition of common words and terms used in their documentation.	There is increasing global workforce movement and there is evidence of variations in international standards. Common standards would ensure and safeguard patient safety and care and be good for global workforce standardization
2	There should be separate definitions of competence at different stages of the course work; separating the undergraduate's progress from readiness to graduate.	Chiropractic educators are better equipped to monitor and assess a student's progress toward detailed graduating standards.
3	*"Abilities"* and *"other categories"* should be included in the definition of competence and their meanings clarified among CCEs.	This would create a clearer understanding of the required standards to be assessed and achieved by chiropractic educators.
	Recommendations in relation to domains	
4	A clarification of the use of the terms and words used to describe the domains of competency should be undertaken so there is an established understanding of their meaning among CCEs.	High levels of descriptions reduce the capacity for ambiguity as they clearly state the expected behaviours and standards of graduates.
5	Common domains of competency need to be created for chiropractic education. These domains should reflect not only practitioner behaviours but also qualities and roles. Consideration should be given to recent examples such as CanMEDS [46] and the ACGME [47]	Adoption of these structures would also improve the likelihood of mainstream integration.
6.	Appropriate descriptive statements should be found that adequately define the domains, sub-domains and their components. These should be sufficiently prescriptive and unambiguous to establish high standards of practice and reduce the possibility of undesirable practice profiles. E.g., radiology competencies, physical examination, and pathophysiology expectations.	CCEs should consider the evidence for a more prescriptive approach to component descriptive statements that would set clearly defined quality graduation standards for educators to achieve and CCEs to enforce.
7	The term "evidence-based" should be used for improved research and knowledge application, such as patient safety and treatment improvements from other mainstream medical disciplines. Further it would facilitate communication and integration within the broader health field. Content taught should be required to be done in the context of the evidence that underpins it.	The adoption of an evidence-based approach would help facilitate integration into mainstream health care.
8	Increased description of ethical and professional practice and practitioner behaviours which are consistent across all CCEs.	Clarity would ensure and safeguard high professional standards.
9	Imaging competencies need to include contemporary modalities such as MRI, CT and diagnostic ultrasound	Health care technology is constantly changing and chiropractic education should keep pace with these changes, so that patients benefit from access to these emerging imaging technologies.
10	CCEs should guide and fund research into accreditation matters: suggested areas include, but not limited to;	This will develop, inform and improve regulatory standards
10 (a).	A study comparing CCEs' levels of enforcement of competency standards.	Identifying the opportunities for improving enforcement of standards may result in a uniform quality international standard of patient care and safety of practice.
10 (b).	A study of factors that may be at odds with competency standards.	Identification of these factors may provide opportunities and mechanisms for chiropractic educators to improve competency levels.
10 (c).	A study trialling interventions targeted at improving identified unwanted practitioner profiles which may alter practice behaviours.	This would improve the quality of patient care and safety

extracted the information with a high level of agreement. Further, all available information was covered and analysed.

Conclusions

This systematic review investigated and identified similarities and differences between the various CCEs in their definitions of graduate competency and the educational competencies they have adopted. The main similarities were found in relation to the structure and terms describing the domain level of competencies. Differences were noted in the interpretation, of those terms. These differences were more pronounced at the component descriptive level. Consequently, a series of recommendations were made. The adoption of these has the potential to create a homogenised, internationally consistent, and high quality set of graduating standards.

Variations in international standards of competency may also be influenced by CCEs differences in enforcement standards or accreditation criteria. This suggests the need for studies comparing similarities and differences of chiropractic college self-evaluation reports and rejoinders to CCE responses, CCE accreditation/inspection team reports, and final reports of findings.

Competing interests
Bruce Walker is Editor-in-Chief and Charlotte Leboeuf-Yde is Senior Editorial Adviser of the journal *Chiropractic & Manual Therapies*. Neither play any part in the assignment of this manuscript to Associate Editors or peer reviewers and are blinded from the editorial system from submission inception to decision. Bruce Walker is Head of the CCE-Aust accredited chiropractic program at Murdoch University in Perth, Western Australia and CLY is a member of the European Council on Chiropractic Education Council of Accreditation.

Authors' contributions
All authors read and approved the final manuscript. SI, BW and CLY were responsible for the study design. SI undertook the data analysis and interpretation. SI developed the initial and iterative draft. BW and CLY were responsible for reviewing and redrafting the final manuscript. All contributed to the final version.

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CHAPTER 3: Systematic review of CCE accreditation standards.

Attribution

Chapter Three of this thesis is published as the following four studies;

- Innes SI, Leboeuf-Yde C, Walker BF. Similarities and differences of accreditation standards of chiropractic councils on education: a systematic review. Chiropractic & Manual Therapies, 2016, **24**:46.
  Accessed 2051 times, Citations 3. Altmetric Attention 2. As at date 12/8/2019
- Innes SI, Leboeuf-Yde C, Walker BF. How comprehensively is evidence-based practice represented in councils on chiropractic education (CCE) educational standards: a systematic audit. Chiropractic & Manual Therapies, 2016 **24**:30. doi**:** 10.1186/s12998-016-0112-0.
  Accessed 1800 times, Citations 4. Altmetric Attention 3. As at date 12/8/2019.
- Innes, S., Leboeuf-Yde C., & Walker B.F., Comparing the old to the new: A comparison of similarities and differences of the accreditation standards of the Chiropractic Council on Education-International from 2010 to 2016. Chiropractic & Manual Therapies, 2018, 26:25.
  Accessed 1259 times, Citations 0. Altmetric Attention 6. As at date 12/8/2019.
- Innes, S., Leboeuf-Yde C., Stomski, N., & Walker B.F., Chiropractic students' perceptions of education: Psychometric evaluation of questionnaire. (In review J Chiropractic Medicine).

For the above studies Stanley Innes (SI) co-designed the methods and analyses with the co-authors, as well as analysing the data and contributed its interpretation. SI drafted and submitted the original manuscript. All other authors critically reviewed and approved the final versions. The exception being “Chiropractic students’ perceptions of education”, where Dr Norman Stomski assisted with the data analysis.

Summary and link to next chapter

Objective 2 sought to compare CCE educational / accreditation standards with the intent of gaining an understanding of the language and expectations by CCEs of CPs. It became apparent that accreditation standard documentation for chiropractic education was too large for a single study and this objective required several studies.

The first study explored the frequency and use of terms associated with an EB approach to education and to clinical practice (EBP). These terms are central to mainstream healthcare provider education. Here, two words were thought to be indicative of a positive approach to EBP (evidence and research) and two were thought to be a negative (*subluxation* and *vitalism*). CCEs were found to under use an EBP approach and were essentially silent on *subluxation* and *vitalism*, the negative words.

The second study systematically reviewed the remaining accreditation standards of the five CCEs using the same tabulation methodology of Chapter One. The World Federation of Medical Education (WFME) accreditation standards were also included for comparison as an example of an existing internationally accepted model. As with CCEs expectations for graduating chiropractors, accreditation standards were found to be more similar than dissimilar. Also, CCEs accreditation standards did not provide definitions for the areas being assessed, thus creating the potential for variable use of common terms. This finding was reinforced with the discovery that standards were low in expectations for faculty qualifications, failed to direct CPs toward mainstream health care expectations of patient-centred care, did not include all stakeholders, and varied considerably in the required content for basic and clinical sciences.

The third paper compared the CCE-International revised educational standards of 2016 with those of 2010. The CCE-International, as a federation of the four regional CCEs, is charged with harmonising world standards to produce quality chiropractic educational programs. Thus, we were able to look for trends in accreditation standards by examining the results of the combined efforts of the four CCEs for deriving an internationally acceptable set of accreditation standards and processes. The 2016 CCE-

International standards were derived by mapping only the four CCEs existing standards and selecting the common themes for inclusion. No external sources or evidence was drawn on. Disconcertingly the pattern of an absent EB approach continued.

The fourth study was conducted to address one of the findings from the first four studies that there was an absence of validated measures for use in accreditation processes to inform CCEs if CPs were achieving the required standards. To this end, the Australian CCE standards were deconstructed to create a survey with four scales to assess chiropractic students' perceptions of their education.

With respect to Objective Two, CCEs accreditation language was found to lack clarity in defining terms surrounding accreditation, used minimal standards, avoided mainstream healthcare terms, and was silent on known conservative / vitalist issues.

This led to Objectives Three and Four in Chapter Four which sought to investigate how CCEs apply these accreditation standards and graduate competencies through the processes of site inspection to monitor for compliance and quality improvements.

Study: Similarities and differences of accreditation standards of CCEs: a systematic review.

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Chiropractic & Manual Therapies

SYSTEMATIC REVIEW Open Access

Similarities and differences of a selection of key accreditation standards between chiropractic councils on education: a systematic review

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Abstract

Background: Councils of Chiropractic Education (CCE) indirectly influence patient care and safety through their role of ensuring the standards of training delivered by chiropractic educational institutions. This is achieved by a process of accreditation where CCEs define and assess graduate competencies and educational standards. A previous study comparing CCE graduate competencies found variations between the CCE jurisdictions. It was proffered that variations in standards may potentially compromise patient care and safety and also inter-jurisdictional mutual recognition. This study continues the examination of CCEs by looking for similarities and differences in CCE accreditation standards.

There were two purposes of this review. The first was to compare the accreditation standards, domains of accreditation standards, and components of the domains of accreditation standards as represented by the domains of "Mission, goals, vision, objectives", "Resources", "Faculty/Academic staff", "Educational program/curriculum". In addition, we compared the accreditation standards between CCEs and those of the widely accepted medical accreditation standards of the World Federation of Medical Education (WFME), in order to search for deficiencies and opportunities for improvements in these standards.

The second purpose was to make recommendations, if significant deficiencies or variations were found.

Method: We undertook a systematic review of the similarities and differences between five CCEs' definitions of an accreditation standard and the descriptive lists of accreditation standards they have adopted. CCE selection criteria and data selection method were undertaken in a systematic manner. This information was tabulated for a comparative analysis and took place in April 2016.

Results: Only two CCEs had a definition of the term "accreditation / educational standard". At the domain level there was considerably more similarities than differences. The differences became more apparent when the comparisons were made at the component level. These included intended purposes of the mission statement, standards for faculty staff, requirements for clinical training by students, program budgetary autonomy and transparency, the inclusion of chiropractic philosophy and history, and which subjects should be taught in basic, behavioural and clinical sciences.

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Conclusions: A series of recommendations were made. These included the need for an increased clarity of the required basic and clinical science subjects, teaching clinic student requirements, and faculty staff qualifications. These are proposed with the intention of creating uniform and high quality international accreditation standards for chiropractic education. Future research should compare the levels of CCEs inspection standards and processes to see if similarities and differences exist also there.

Trial registration: Not applicable.

Keywords: Councils on chiropractic education, Standards of accreditation, Similarities, Differences

Introduction

Background

Worldwide there are many chiropractic programs. Accreditation authorities assess these programs to ensure that certain professional standards are met in chiropractic pre-professional training so that patients receive the best care possible from graduates of those programs.

Accreditation of higher education is a process by which official accrediting bodies evaluate institutions using a set of standards and procedures to assess the contents and level of quality of education provided in the hope of producing competent graduates in specific professions [1]. Obviously, the value of the accreditation process depends on the standards and procedures that form their basis. The use of competencies, policies, accreditation standards and site inspections are now widely recognised as an important basis needed to be able to assess programs for accreditation [2, 3]. Additional objectives of the accreditation process are to ensure quality institutional functioning, to strengthen the capabilities of educational institutions and to provide public confidence in health practitioner educational institutions generally [1]. Within chiropractic, Councils on Chiropractic Education (CCE) are responsible for the accreditation of institutions.

CCEs expect chiropractic programs to train students to attain satisfactory levels of knowledge, skills and attitudes before graduating. These are known as competencies and are specified by CCEs. Previous research has shown that while there are similarities, there is also considerable variation among the CCEs' written documentation, including definitions of important terms, for entry-level graduate competencies [4]. These definitions and construction of competencies have important implications for the way that competence based medical education is implemented [2]. However, this aspect is only part of the accrediting process. CCEs prescribe a set of educational standards for accreditation of chiropractic programs. These accreditation standards detail, amongst other things, the required program content, facilities, faculty and financial management.

The problem

There are studies in medical education exploring the impact of accreditation standards prescribed by regulatory or licensing agencies [5–10]. These studies have resulted in a dialogue from which medical programs and regulatory bodies have been able to explore and improve the strengths and weaknesses of the accreditation process. However, there are none in chiropractic education. It is obvious that relevant and uniform standards are needed to ensure patient safety and protection as well as international transportability of professionals [11]. Nevertheless, past research has shown that there are significant variations between CCEs in relation to competencies [4]. This may result in differing requirements and processes of accreditation between these CCEs. If variations also exist in the educational standards of CCEs this may result in differing quality levels of practitioner profiles, which could create differences in the quality of care and patient safety. While there may be several ways of achieving the same high quality graduate attributes, variations of approach may also produce differing levels of quality. Ultimately, an unequal and deficient standard may also impact on the international mobility of chiropractors.

A comparison standard

In 2004 the World Health Organisation and the World Medical Association approved the World Federation for Medical Education (WFME) project for an international collaboration programme for the reorientation of medical education [12]. This project was concerned with the education and training of medical doctors in order to improve the health of all people through the promotion of high quality medical education [13]. Consequently, the WFME published a set of international standards intended to be used as a tool for quality assurance and development of basic medical education as well as for the evaluation and recognition of accrediting agencies [14]. The most recent revision was published in 2015 [15]. These standards have been used in over 70 countries and over 500 medical schools have now adopted them for their mandatory self-evaluation studies [12]. It is recognized that chiropractic standards will differ in some areas to medicine. However, they both share

common basic sciences and clinical sciences which mean that this extensively researched and widely adopted set of standards offers a useful benchmark for an investigation into the similarities, differences and possible deficiencies between chiropractic accrediting agencies.

Aim

The aim of this systematic review was to answer the question; are there similarities and differences between the various CCEs on the accreditation standards they have adopted? Further, by comparing these to the standards of the WFME and see if there are opportunities for improvement.

Objectives

The specific objectives were to review and compare the different CCE definitions of:

1. Accreditation standards;
2. Domains of accreditation standards;
3. Components of the domains of accreditation standards as represented by the domains of "Mission, goals, vision, objectives", "Resources", "Faculty/ Academic staff", "Educational program/curriculum".

In addition, we compared the accreditation standards between CCEs and those of the WFME, in order to search for deficiencies and opportunities for improvements in these standards.

Method

We used the same design as in our previous study, namely a systematic review to investigate the first three objectives [4]. Protocols for clinical systematic reviews are recommended to be prospectively registered (PRISMA [16]). However, as this systematic review focussed on the descriptive definitions in accreditation standards documents and not peer reviewed journal articles, it was not suitable for prospective registration with databases such as PROSPERO [17]. This study, which took place in April 2016, was an analysis of freely available website content and did not involve collecting data from human participants, hence ethics approval was not required.

Eligibility criteria

The World Health Organisation recommends the Council on Chiropractic Education International (CCE-International) as the source of information regarding evaluation of chiropractic education [18]. Consequently, for CCE inclusion, we used this recommendation meaning that a CCE included in our study had to be recognized by and be a member in good standing of the CCE-Int. At the time of data collection (November, 2015) all the CCEs known to us, i.e. the Council on Chiropractic Education (CCE-USA) [19], Council on Chiropractic Education Australasia (CCE-Australasia) [20], European Council on Chiropractic Education (CCE-Europe) [21], and Council on Chiropractic Education Canada (CCE-Canada) [22], met the inclusion criteria. The CCE-International standards were also included in the analysis [23]. Its function is not, strictly speaking, the same as that of the other CCEs, in that it does not actively inspect chiropractic institution, however it functions as an "umbrella" organisation for all the included CCEs and thus warrants inclusion.

Data extraction process and synthesis of results

The respective CCE websites were identified and searched independently by the lead author and a research assistant. All CCEs were asked in writing whether additional relevant information was available that was not available on their respective websites.

A Masters in Business Administration graduate experienced with organisational evaluation acted as a research assistant and was instructed on the search domains. A training exercise was undertaken to establish a consistent process for extracting data from the websites. The research assistant was instructed on the aims and objectives of the project. Further, the roles of the CCEs were defined. The lead author and the research assistant then independently searched the CCE websites to identify and extract a definition of an accreditation or educational standard. The extracted data were recorded and tabulated. The author and research assistant then compared these for agreement. A third investigator was available to resolve any conflicts.

The same process was repeated for the extraction of the Accreditation Standards lists for each CCE.

The table format for the definitions was structured to identify similarities and differences with respect to their definitions and descriptions of the concept of "educational standards", and the four domains of: 1. Mission, vision, goals, objectives, 2. Faculty/Academic staff, 3. Resources, and 4. Educational program/Curriculum.

Finally, the components of the four selected domains were extracted and tabulated, as described in Fig. 1, and thereafter analysed for similarities and differences.

Results

The research assistant and lead author (SI) agreed on all blindly extracted definitions of an educational standard. There was also agreement on all 5 of the CCE lists of accreditation standards.

Objective 1: definitions of educational standards

Two definitions of the term "educational standard" were found in the accreditation standards of the five CCEs (Table 1). The CCE-Australasia, which uses the term educational standard instead of accreditation standard, defined it as a criterion used as a model or pattern. The

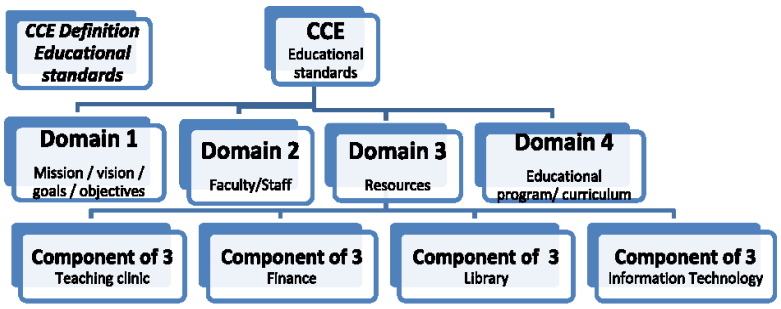

Fig. 1 Diagram of the systematic review structure

CCE-Europe definition was more extensive and defined it as a set of pre-determined criteria to certify that an institution is providing an education so that its graduates achieve their core competencies. No other definitions were found.

Objective 2: domains of educational standards

The analysis revealed 13 domains among the five CCEs accreditation standards and nine domains in the WFME standards (Table 2). There were considerably more similarities than differences. The CCE-USA alone had a domain called "Ethics & integrity". This topic was found as a subdomain of CCE-Australasia and CCE-Europe standards. The CCE-USA also had two unique domains called "Distance/Correspondence education" and "Service". Since they were single occurrences at the domain level in only one CCE they could not be compared and consequently were not included. This left 10 domains that were common to all CCE standards. Of these 10, a comparison of the domain of "Research/Scholarship" has been presented elsewhere [24]. Further the domains of "Program evaluation", "Continuous renewal/Improvement", "Student services" and "Student admissions" will be the subject of a future study and were excluded.

For the purposes of this review we concentrated on the remaining four important domains of;

1. Mission/Vision/Goals/Objectives
2. Faculty/Staff
3. Resources
4. Educational program/ Curriculum

Table 1 Definitions of educational standards used by the major regulatory bodies

Name of CCE	Definition of "educational standard"
CCE-Aust	Offers a rule or basis of comparison established in measuring or judging capacity, quantity, quality, content and value; criterion used as a model or pattern. *Pg 20, 2009, Educational Standards for First Professional Awards Program in Chiropractic. CCE-Australasia* [20]
CCE-Canada	No definition found [22],
ECC-Europe	Set of pre-determined criteria by which judgements and/or decisions are made to certify that an institution is providing an education and training to ensure that all its graduates achieve the core competencies. *Pg 62, ECCE Standards, 2013.*[21]
CCE-Int	No definition found [23]
CCE -USA	No definition found [19]
WFME	No definition found [15]

Objective 3: comparative analysis of four domains of educational standards

Domain 1 of accreditation standards: mission/vision/goals /objectives

All CCEs documentation included the requirement for educational programs to clearly define their mission/vision/goals/aims/objectives (Table 3). The CCE-Australasia expected the mission statement to be based on input by its principal stakeholders. Principal stakeholders were listed as staff, students, community, education and health care authorities, professional organizations and post-graduate educators. The CCE-Europe and CCE-USA made it a requirement to make the mission statement known to all stakeholders.

There was a diversity of descriptive terms for the intended purpose of the mission/vision/goals/objectives statement. The accreditation standard of the CCE-USA recorded that the intention of the mission statement was to provide for the design of an educational program leading to the qualification of a chiropractor with measureable goals that enable the assessment of the effectiveness for achieving this. The remaining regulatory / licencing bodies intended the mission statement to be used as a measure of the standards to be achieved for a student to graduate. These included becoming a life-long learner, competent, safe, and someone who would serve the community and work with other health professionals.

The CCEs mission statements were more similar than dissimilar when compared to the WFME standards. They

Table 2 Comparison of Educational standards Domains of CCEs

Major Elements/Domains of Educational standards	WFME	CCE-Aust	CCE- Can	ECC-Europe	CCE-Int	CCE-USA
Mission/Planning/Assessment/Vision/Goals/Objectives	X	X	X	X	X	X
Resources/Educational resources	X	X	X	X	X	X
Educational program/Curriculum	X	X	X	X	X	X
Faculty	X	X	X	X	X	X
Scholarship/Research and relationship to teaching		X	X	X	X	X
Student admissions	X	X	X	X		X
Student services	X	X	X	X		X
Governance/Administration/Structure/Organisational factors	X	X	X	X	X	X
Ethics & integrity						X
Continuous renewal & improvement	X	X	X	X	X	X
Distance/correspondence education						X
Service						X

were similar in that the CCEs and WFME required that they should be made known to the constituency and community, as well as resulting in the production of a competent practitioner. It was uncommon that CCEs' mission statements (see Table 3) were found to have included the WFME requirement that the mission statement should result in the production of lifelong learners, be socially accountable, include research, and prepare graduates for post graduate education. It is not unexpected that CCEs would universally include preparation for post graduate education as they are primarily focused on undergraduate training.

Domain 2: faculty/staff

Accreditation Standards in all CCEs' documents stated that staff should be appropriately or adequately qualified and experienced. Three CCEs (Australia, Canada and International) quantified the minimum qualification as being 3 years full-time work experience and current registration for clinical staff. The CCEs of Australasia, Europe and USA expect that the staff should be capable of developing, delivering and monitoring courses and curricula. Two CCEs (Australasia and Canada) required the presence of a least one Ph.D. qualified staff member in the basic sciences.

A wide range of staff scaffolding measures were found in three of the five CCEs (see Table 3). These included induction procedures, professional development and appropriate support from administrative staff. The standards of the CCE-Europe and CCE-USA expected there to be a balance between full-time and part-time faculty though the ratio is not specified. Only the CCEs of Australasia and Europe require that there be a balance between chiropractic and non-chiropractic staff but this ratio is also not stipulated. Finally, all but CCE-Canada demanded the presence of a stable academic staff population.

When compared to the WFME standards the following differences were noted. CCEs used the words "adequate" or "appropriately" qualified staff as compared to "highly" qualified by the WFME. Further, not all CCEs required a balance in staffing levels for the basic sciences and clinical sciences, as well as a balance of full-time versus part-time staff. The WFME standards were unique in that they stipulated the need for a balance between teaching, research and service functions, as well as stating that faculty should have a sufficient knowledge of the total curriculum.

Domain 3: resources

Teaching clinics All CCEs accreditation standards matched those of the WFME. All expected the provision of teaching clinics and that they should be appropriately resourced for the delivery of training. All, except the CCE-Europe, required mechanisms to determine if patient care deficiencies existed. All, except the CCE-USA, expected a sufficient case mix of patients. The standards of the CCE-Australasia alone required that care be patient-centred. The notable omission in the CCEs´ standards when contrasted to the WFME standard was the expectation by the WFME that teaching clinics should be evaluated, adapted and improved to meet the needs of the population it serves .

Finances All CCE standards documentation contained the expectation that sufficient finances should be available for programs to meet their overall aims. The CCE-Australasia, Europe and USA required programs to have sufficient autonomy or control over their financial resources to achieve their overall objectives. All CCEs required budgetary considerations to encompass the most recently enrolled graduates, except CCE-Canada who required a fiscal policy for a single year. The CCEs of USA and Canada required audits. The CCE International and CCE-Canada expected programs to meet all legal accounting procedures.

The WFME standards were more general in nature but were similar to the varying CCEs´ financial standards with the requirement that programs should have budgetary

Table 3 Descriptions used by CCEs of the three selected representative domains of "Mission, goals, vision, objectives", "Resources", "Faculty/Academic staff"

Educational Standard : Mission/goals/vision/objectives	WFME	CCE-Aust	CCE-Can	ECC-Euro	CCE-Int	CCE-USA
Provide/define a mission/goal/objective statement	X	X	X	X	X	X
Based on input by stakeholders		X				
Made known/available to all stakeholders	X	X		X		X
Describe the desired graduate as competent primary contact practitioner	X	X	X	X		
as a safe practitioner	X			X		
as able to work with other practitioners/health care environment	X	X		X	X	
competent to diagnose and care for the patient	X	X		X	X	X
Statement be used as a standard for self-evaluation						X
Include research related to chiropractic (medicine for WFME)	X	X	X		X	X
Should include social responsibility/service to the community	X	X	X		X	
Committed to life-long learning	X	X		X		
Prepared and ready for post graduate education	X	X				
Include social accountability	X	X				
Educational Standard : Resources	WFME	CCE-Aust	CCE-Can	CCE-Euro	CCE-Int	CCE-USA
Student Teaching Clinic						
Expectation of providing a student teaching clinic	X	X	X	X	X	X
Must be appropriately resourced	X	X	X	X	X	X
Clear and identifiable policies/evidence of						
Patient centred care		X				
Appropriate case mix	X	X	X	X		
Meet all legal requirements			X			
All teaching facilities approved by the "program"		X	X	X		X
Focused on comprehensive and appropriate care	X	X	X	X		
Mechanisms to determine any patient care deficiencies	X	X	X			X
Show proof that the clinics meet the mission / objective statements		X	X	X		X
Provide sufficient supervision	X	X	X	X		X
Evaluate, adapt, improve facilities for clinical training to meet population it serves	X					
Finance						
Adequate & stable finances to support program meet goals/mission	X	X		X	X	X
Must be audited			X			
Fair & equitable refund policy			X			
Length of financial stability		5 years	1 year	5 years	5 years	Long term
Budgetary autonomy	X	X		X		X
Meet legal requirements			X		X	
Budgetary autonomy	X					
Budgetary transparency	X					
Library & Learning Resources						
Adequate support for learning resources to support program goals/objectives	X	X	X	X	X	X
Access to learning resources	X			X	X	X
Adequate for teaching and research	X			X		
A safe learning environment	X					

Table 3 Descriptions used by CCEs of the three selected representative domains of "Mission, goals, vision, objectives", "Resources", "Faculty/Academic staff" *(Continued)*

Information Technology (I.T.)						
Provide I.T. facilities	X	X	X	X		X
Sufficient to deliver the curriculum	X	X	X	X		X
Ensure access to web-based or other electronic media	X					
Effective, ethical, evaluation of appropriate IT and communication technology	X					
I.T. used for independent learning, managing patients, work in health care systems	X					
Physical Facilities						
Provide adequate assets (human & systems) for goals/objectives	X	X	X	X	X	X
Meet legal requirements		X	X	X		
Instructional Aids & Equipment						
Clinic equipment sufficient to meet objectives		X	X	X	X	X
Students obtain acceptable knowledge & skills of standard diagnostic & therapeutic equipment		X		X	X	
Educational Standard : Faculty/Academic staff	WFME	CCE-Aust	CCE-Can	ECC-Euro	CCE-Int	CCE-USA
Appropriately qualified & experienced staff (WFME highly qualified)	X	X	X	X	X	X
Staff should be able to develop, deliver, monitor courses & curricula	X	X		X		X
Stable academic staff		X	X	X	X	X
Balance between chiropractic & non-chiropractic staff (medical/non-medical WFME)	X	X		X		
Balance between F/T and P/T faculty	X			X		X
Minimum chiropractic qualification of 3 years F/T work experience & currently registered	N/A	X Phd	X-Phd	X	X	X
Induction procedures for new staff		X		X		
Staff professional development	X	X	X	X		X
Appropriate administrative staff to support implementation of program	X	X	X	X		X
Regular reviews of staff/management/administrative staff	X	X	X	X		X
Criteria for the balance between teaching/research/service functions	X					
Ensure sufficient knowledge of staff of the total curriculum	X					
Design & implement a staff promotion policy	X		X			X
Take into account staff – student ratios	X	X	X	X	X	X
Educational Standard : Educational Program/Curriculum	WFME	CCE-Aust	CCE-Can	ECC-Euro	CCE-Int	CCE-USA
Curriculum should be consistent with program objectives	X	X		X		
Length of course		10 semesters	4,200 h	300 ECTS		4,200 h
Clinical training length	1/3 total program			1 year		A portion
Number of new Patient encounters for student to graduate		50	35	35		
Number of X-rays studies		60	35			
Number of patient treatments		300	250			
Clinical laboratory tests		25				

autonomy and a transparent plan to meet its educational objectives. No timelines for budgetary projections or proof of financial stability going forward were suggested by the WFME standards.

Library and learning resources All accreditation standards required that programs should provide appropriately staffed library and learning resources sufficient to support the educational institutions mission and goals.

The documents for two CCEs stated that it should be accessible (CCE-USA & International). Adequate information technology facilities for teaching the curriculum were expected by all CCEs except the CCE-International.

CCE standards generally met those of the WFME. The CCE-USA and the WFME both contained the requirement of the need to provide a safe learning environment for students. Detail as to what constitutes "adequate" or "appropriate" is not provided by WFME or CCE standards.

Physical facilities and Instructional aids and equipment All accreditation standards expected the provision of adequate clinic and learning equipment for achieving mission objectives. The CCEs of Australasia and Europe obliged programs to provide these to a level so that students can obtain acceptable knowledge and skills of standard diagnostic and therapeutic equipment.

The educational standards of all CCEs expected the provision of adequate assets/facilities for the programs to meet their objectives. The standards of CCE-Australasia, CCE-Canada and CCE-Europe expected that these should meet legal and safety requirements.

The standards as recorded by the CCEs´ documents, although worded differently, appeared uniform and comprehensive and were comparable with the WFME standards within this subdomain.

Domain 4: educational programs/curriculum

The number of contact hours and patient consultations stipulated for training Although all CCEs related the duration/extent of courses, this was defined in different ways: as five years of study/10 semesters (CCE-International/CCE-Australasia respectively), 4,200 h (CCE-Canada and USA) and 300 European Credits Transfer Scheme (CCE-Europe). The WFME makes no recommendation for an appropriate length of time for medical training.

The length of clinical training for chiropractic students was set at 1 year and a minimum of 35 new patient assessments by the CCE-Europe standards. The same number of new patient assessments was also found in the CCE-Canada accreditation standards, as well as 35 X-ray series and 250 patient treatments. This number was increased to 50 new patients, 60 X-ray series, 300 patient treatments and 25 clinical laboratory tests in the CCE-Australasia standards. The CCE-USA accreditation standard was found to record the length of clinic training as "a portion of the course". The WFME require that a reasonable part (defined as one third of the program) should be spent in planned contact with patients in relevant clinical settings.

In summary, there appeared to be agreement between CCEs on the total program course length, but differing descriptors were used. However, there was considerable variation between clinical training requirements of CCEs and all of these were different to the WFME standards which contained the stipulation that at least one third of the program to be spent in patient contact.

The curriculum All CCEs and the WFME standards were found to have recorded that the faculty should have the freedom to design the curriculum as well as the resources to implement it (See Table 4). Curriculum development was not specifically mentioned in the CCE-Canada standards. However it is possible that curriculum development could be viewed as a component of the overall assessment of the program under the domain of "Evaluation, Planning and Effectiveness".

Two of the standards (Australasia and Europe) and the WFME required that the curriculum committee should be represented by staff, students and other stakeholders and that the program should be modified in response to feedback from society.

There was uniformity among all CCEs and WFME standards that the curriculum should prepare students to be lifelong and self-directed learners. All CCEs also dictated that curriculum models and instructional methods should be consistent with the stated goals of the chiropractic program. The requirement that curriculum models should facilitate higher learning was found in the CCE standards of Canada and Europe. Only the Australasian and WFME standards made the demand that students should be responsible for their own learning processes.

All CCEs and WFME accreditation standards for chiropractic institutions were instructed to incorporate and integrate the basic sciences in a coherent manner that creates an understanding of the scientific knowledge, concepts, and methods fundamental to acquiring clinical science knowledge. However, only the CCE documents of Australasia and Canada required that the "average" student loads be "reasonable". The CCEs of Australasia and Europe and the WFME documents expected evidence-based health care to be taught throughout the curriculum. This topic is covered in more detail in a previous publication [24].

There was wide agreement in all CCE documents that students should be taught adequate clinical, behavioural and social sciences, and ethics, and that they should have access to "experiences" with patients and opportunities to acquire sufficient clinical knowledge, skills, and desirable attitudes to assume appropriate ethical clinical responsibility upon graduation.

Some requirements were only recorded in one CCE accreditation standards: basic science and clinical staff should collaborate around clinical problems (CCE-Europe), and curriculum should be adapted to scientific developments and the health needs of society (CCE-Australasia).

Table 4 Curriculum/program subdomains of CCE educational standards

	WFME	CCE-Aust	CCE-Can	CCE-Euro	CCE-Int	CCE-USA
Curriculum Development						
- Faculty must have freedom to design it	X	X		X	X	X
- Freedom to allocate resources necessary to its implementation	X	X	X	X	X	X
- Curriculum committee represented by staff, students, other stakeholders	X	X		X		X
- Modify program in response to feedback from community and society	X	X		X		
Models and instructional methods						
- Curriculum models & instructional methods should be consistent with goals of the institution	X	X	X	X		X
- Curriculum should include multiple learning models/appropriate learning models methods	X	X		X		X
- Students responsible for their learning process	X	X				
- Students should be prepared to be lifelong & self-directed learners	X	X	X	X	X	X
- Should facilitate higher-level learning			X	X		
Structure		X				
- Institution should document the content, extent and sequencing of the courses & how they are integrated into a coherent program	X	X	X	X	X	X
- Basic sciences and clinical subjects should be integrated in the curriculum	X	X	X	X	X	X
- The average student loads should be reasonable		X	X			
Program Content						
- Should ensure achievement of the clinical competencies	X	X	X	X	X	X
Principles and practice of chiropractic		X	X			X
- Identify & incorporate a profile of the philosophical concepts & principles of chiropractic	N/A	X			X	X
- The development of chiropractic practice (medical practice)		X			X	X
- This will create an understanding of the position of chiropractic (medicine) in health care system	X	X	X		X	
Basic sciences						
- Identify & incorporate those basic sciences that create an understanding of the scientific knowledge, concepts, methods, fundamental to acquiring clinical science	X	X	X	X	X	X
- Should be adapted to the health needs of the society	X	X				
- EB health care must be taught throughout the curriculum	X	X		X		
- Contains a list of basic sciences subjects to be taught	X	X	X	X	X	X
Clinical sciences						
- Students must have adequate patient experiences & opportunities to acquire sufficient clinical knowledge, skills & attitudes to assume appropriate clinical responsibility on graduation	X	X	X	X	X	
- List of clinical sciences	X	X	X	X	X	X
- Basic sciences staff and clinicians should collaborate around clinical problems	X			X		
- Contains a list of clinical subjects & skills to be taught	X	X	X	X	X	X
Behavioural and social sciences and ethics		X	X	X		
- Identify and incorporate behavioural & social sciences and ethics that enable effective communication, clinical decision making & ethical practice	X	X	X	X		X
- These adapted to scientific developments in chiropractic & changing demographic & cultural contexts & to health needs society	X	X				
- Contains a list of behavioural & social science & ethics subjects to be taught	X	X		X		

In summary, some CCEs did not contain the following component areas found in the WFME standards; the curriculum committee should be represented by all stakeholders, the curriculum should be modified by stakeholders and should include appropriate learning models that require students to be responsible for the learning processes as well as facilitating life-long and higher learning processes, and average student loads should be reasonable.

Program content All CCE agencies and the WFME standards were in accord that the program content should ensure achievement of the stated clinical competencies(See Table 4). Differences were noted in that the CCEs of Australasia, USA and International did require the inclusion of the philosophical concepts & principles of chiropractic or the development of chiropractic practice, but those of Canada and Europe did not. All CCEs' accreditation standards were similar in the stipulation that program content should include the sub-domains of basic, behavioural, social and clinical sciences, further, that these subjects should be adapted to the changing demographics, cultural contexts and health needs of society. The WFME, CCE-Australasia and CCE-Europe required that evidence-based health care be taught throughout the curriculum.

Subjects required for basic, behavioural and clinical sciences The CCE accreditation standards of Australasia, Canada, Europe and USA contained lists of subjects required to be taught under the subject areas of principles and practice of chiropractic, basic, clinical and behavioural sciences whereas the CCE-International did not list any required subjects. There were 53 subjects stipulated across these four remaining CCE subject lists (Table 5). Thirteen of these were common to the four CCE standards documents (excluding the CCE-International); anatomy, biochemistry, microbiology, neurology, pathology, physiology, biomechanics, nutrition, orthopaedics, diagnostic imaging, physical, clinical and laboratory diagnosis, adjusting techniques, and spinal analysis. Twenty-three were found in only one CCE educational standards document and included subjects such as practice ethics and management (CCE-Australasia); mental health assessment (CCE-Australasia); reflective practice skills, legal aspects of practice and chiropractic history (CCE-Europe); and wellness, toxicology, extremity adjusting (CCE-USA).

Subjects that were in the WFME lists but not in all CCE lists included genetics, immunology, public health, biostatistics, clinical decision making, dermatology, epidemiology, first aid emergency procedures, geriatrics, gynaecology, legal aspects of practice, mental health assessment, obstetrics, ophthalmology, pain management, pharmacology, psychology, practice ethics, research methods and procedures, and sociology, and evidence-based medicine.

Discussion

This systematic review is the first to show similarities and differences between accreditation standards as prescribed by CCEs. It also compared the chiropractic standards to those of the WFME. Generally, there were many differences but also some similarities and it is apparent that the WFME standards can be used for further guidance on how to improve and homogenize chiropractic accreditation standards.

Objective 1: definitions of educational standards

In a previous paper comparing definitions of competency [25] it was noted that one broad definition was not suitable for all professions [26] and that what is required are specific definitions that have sufficient detail and clarity to be professionally and educationally useful [27].

In relation to the five CCEs definition of the term "educational/accreditation standard", it was actually present only in two instances, and only one of these included detail specific to chiropractic education. Nevertheless, the domains of the accreditation standards were more similar than dissimilar across the five CCEs. The differences, however, became increasingly evident when the detail of the component lists describing the domains were compared.

Objective 2: domain analysis of educational standards

There were considerably more similarities than differences in the domains of the accreditation standards of the CCEs. One example of a difference is the domain of "Ethics and Integrity" which was listed at the Domain in one CCE and at the subdomain level in 2 others. Concerns have been raised over chiropractic business ethics in the past [28]. These have included unsubstantiated claims in patient brochures [29], anti-immunization views [30] and the sale of "good health" products [31] among others. One solution suggested has been the establishment of a broader based and more congruent undergraduate ethics curriculum [32]. We could no evidence to suggest that by including this as a domain in accreditation standards, although intrinsically appealing, would impact on poor business ethics in future graduates.

It is important that standards follow educational and technological development, so that, for example, they relate to use of the internet in educational institutions. Consequently, we would recommend that all CCEs consider including "Distance/correspondence education" in their accreditation standards so as to embrace all "on-line" teaching.

Objective 3: selected subdomain analysis of educational standards

Domain 1: mission/vision/goals/objectives

One strategic tool that both academics and practitioners have deemed critical to the success of any health-care organization is the development of a meaningful mission

Table 5 Subject lists expected to be part of chiropractic program curriculum in CCE educational standards

	WFME	CCE-Aust	CCE-Can	CCE-Euro	CCE-Int	CCE-USA
Fundamental knowledge of health sciences	X				X	
Normal & abnormal patho-physiology of NMSK system	X				X	
Basic Sciences						
Anatomy	X	X	X	X		X
Biochemistry	X	X	X	X		X
Biophysics		X		X		
Genetics	X	X		X		
Immunology	X	X		X		
Microbiology	X	X	X	X		X
Neurology	X	X	X	X		X
Molecular & cell biology	X	X	X	X		
Pathology	X	X	X	X		X
Physiology	X	X	X	X		X
Public health	X	X	X	X		
Clinical sciences						
Adjustive technique	N/A	X	X	X	X	X
Biostatistics	X		X			
Biopsychosocial model of pain	X			X		
Biomechanics		X	X	X	X	X
Chiropractic history	N/A			X		
Clinical decision making	X					X
Diagnostic imaging procedures		X	X	X	X	
Dermatology	X	X	X			
Epidemiology	X		X			
Ergonomics		X				
Extremity adjusting	N/A					X
First aid & emergency procedures	X	X				X
Geriatrics	X	X	X			
Gynaecology	X	X	X			
Legal aspects of practice	X			X		
Mental health assessment	X	X				
Nutrition / dietetics		X	X	X		X
Obstetrics	X	X	X			
Ophthalmology	X	X				
Oral & written communication skills	X			X		
Organ systems	X					X
Orthopaedics	X	X	X	X	X	X
Otolaryngology	X	X	X			X
Pain management	X			X		
Paediatrics	X	X	X			
Patient management (active & patient centred)	X			X		X
Pharmacology	X	X		X		
Physical, clinical & laboratory diagnosis	X	X	X	X	X	X
Psychology	X		X			

Table 5 Subject lists expected to be part of chiropractic program curriculum in CCE educational standards *(Continued)*

Practice ethics	X	X				
Practice management		X		X		
Principles & practice of chiropractic	N/A		X			
Professional practice ethics & interprofessional collaboration	X		X			
Reflective practice skills				X		
Research methods & procedures	X		X		X	
Rehabilitation & therapeutic modalities	X	X		X	X	X
Sociology	X		X			
Special populations				X		
Spinal analysis	N/A	X	X	X		X
Toxicology						X
Wellness						X

statement [33]. The presence of the requirement for a mission statement or objectives in all CCEs and the WFME standards reflects this attitude. There is literature on the difficulties in creating effective mission statements [33, 34], and it is important that CCEs put some effort into the formulation of mission statements with an understanding that they are used with the view of implementation.

There were considerable differences between CCE accreditation standards on who should define the mission statement. This varies from basing it on input from all stakeholders (staff, profession, patient groups and society) through to an obligation to make it known to them. The chiropractic profession is not homogeneous [25]. Programs may find themselves in an environment where there are two professional groups, one being vitalist or "philosophically" driven while the other is based on biological plausibility and, as far as possible, on evidence [35]. It is the authors' contention, and that of others, that the greatest opportunities for chiropractic lie in the integration into mainstream healthcare and this must be founded on evidence-based health care [36, 37]. To this end mission statements cannot be based on all stakeholders input if they are non-evidence based, such as vitalism or "traditional" chiropractic philosophy. CCEs should be clear in their directives to programs on which input should and should not be given consideration for the construction of their mission statements.

It should be noted that some programs must align their mission statements with that of the university systems they are part of. Due consideration should be given to this imperative as more chiropractic institutions become integrated with government funded universities.

Tabulation of the mission statements revealed that they differed in purpose. Some intended it to be used as a standard for program self-evaluation, whereas others thought it should be used for describing the educational strategy for producing the competent graduate. Thus the graduate was described differently across CCEs standards. Careful consideration should be given to the use of detailed and specific terminology in order to remove descriptive vagueness. By doing this with mission statements they can be better used for their intended purpose of course evaluation and can fully inform educators of the "end product" they are required to produce. We would recommend an increase in the descriptive language specific with respect to their intended purpose for mission statements. Consideration should be given to including identified terms from this analysis such as "lifelong learner".

Domain 2: resources

Teaching clinics There was a consensus among CCE standards on the need for a teaching clinic, but little uniformity on the specific detail for appropriate standards. For example, non-uniformity was demonstrated in that not all CCE standards included the stipulation for patient centred care, meeting all legal requirements, providing comprehensive and appropriate care, or mechanisms to determine if there were any patient care deficiencies present. The amalgamation and adoption of evidence-based standards, such as these, has been shown to enhance the student experience and produce graduates of a higher quality and should be adopted by all CCEs [38].

Our review revealed that all but the CCE-USA mentioned the case-mix of patients. Although none addressed the issue of students having to recruit their own patients, CCE-Canada and CCE-Australasia limited the proportion of family and/or friends allowed. Case mix has been shown to be positively related to learning outcomes, practitioner reported self-confidence, comfort level and learning benefit in medical education [39]. This suggests that chiropractic students being exposed to a broader case mix, such as hospital settings, could enhance their learning and as such should be considered.

Finances Quality international business standards would, at a minimum, require the meeting of all legal requirements, adequate provision of finances to allow all students currently enrolled to graduate, transparent annual reporting, and independent auditing [40]. This minimum standard was not uniformly prescribed across all CCE accreditation standards. For example, there was not a uniform requirement for programs to have autonomy or control over their budgets. The authors recognise that there may be variations between geographic locations where other agencies may regulate or accredit various elements in chiropractic programmes. For example regional agencies may have robust financial evaluation standards which reduces the need for CCEs to perform to the same level.

A particular problem could be that chiropractic programs amalgamated with universities may have a reduced capacity for input or control over their budgets. This should be guarded against by clearly stating this requirement in the CCE accreditation standards.

Domain 3: faculty/academic staff

Accreditation standards in all CCEs stated that staff should be appropriately qualified, experienced and supported by appropriate administrative staff. The most commonly expressed qualification was registration and three years practice experience. The authors believe that if chiropractic education is to become a respected member of the health professions then its staff should be encouraged, via educational standard requirements, to attain the broader health industry standard i.e. a research doctorate such as a Ph.D. and that the number of staff with this requirement should be considerable. At a minimum the requirement should be to adopt the WFME standard of "highly qualified" for program staff.

CCE standards did not include the WFME standards for faculty to have a balance between teaching, research and service functions, as well as having a sufficient knowledge of the total curriculum. This would appear to be important. Medical faculty who had out-dated research methodologies, poor skills in critical evaluation of medical information and authoritarian teaching relationships were found to be barriers to the adoption of evidence-based medicine [41]. The major self-report vocational concerns of medical faculty also related to research publications and teaching [42]. It is likely that chiropractic educators would be similar, however no research could be found to verify this.

Sub-domain 4: educational program / curriculum

The curriculum / educational program was the largest domain for analysis. Two methods of determining a student's preparedness for graduation were found. One was the student having attained a level of competence as specified in the graduate competency standards. The second was evidence of having completed a specified number of new and returning patient assessments and treatments. Medical education is moving away from a time or numbers-based system and toward attaining competencies [43]. However, some have suggested that both should be used [44, 45]. We could not find any research which gave direction as to what numbers of patient treatment encounters were optimal for producing competent chiropractic graduates. It is important that educators keep informed of recent developments in this area and that they re-consider the old system of counting numbers of patient visits to justify clinical competency. Research is needed to determine the impact that the number of clinical encounters or the amount of time spent in a training clinic has on students attaining competency to practice safely and effectively. It must be remembered, that when programs are aligned with universities, they have to meet the expectations also of the university.

All CCEs accreditation standards required curriculum models and instructional methods to be consistent with the goals of the institution. Although current evidence suggests that the best way to teach, at least for some subjects [46], is by combining multiple pedagogical resources to complement one another and that students appear to learn more effectively when multimodal and system-based approaches are integrated [40], this was not generally required across the CCEs. Therefore, CCEs need to recommend suitable staff development and upgrading in the pedagogic domain to ensure that not only the contents of the courses but also the delivery of the courses is suitable.

Program content was generally conceptualised in all CCE accreditation standards as consisting of four components. However, there was considerable diversity in the subjects mandated for each of these components among CCEs. It is possible that this was in part due to differing scopes of practice between the CCEs. Medical education has recognized the need to delineate the subjects, and areas within subjects, required for the purpose of graduating the safe and effective medical practitioner. For example studies have been conducted to try to identify which areas of anatomy constitute the required body of anatomy knowledge [47, 48]. No studies could be identified for purposes of graduating the safe and effective chiropractic practitioner. Such studies could create a clearly defined knowledge base from which programs could produce quality graduates. It is expected that this core or common body of knowledge would change over time. For example, it is possible that there will be an increasing emphasis on MRI and ultrasound imaging modalities [49, 50].

Methodological considerations

A potential weakness of this study is the subjective nature of the interpretation of the structure for the

analysis of the domain and component statements. Our choice of sub-domains may differ from others. There may be other possible constructs for analyses which may impact on the differences and similarities observed.

The strengths of this review are that it did take a systematic approach and that the two investigators extracted the information blindly and with a high level of agreement. Further, all available information was covered and analysed.

Conclusions

This systematic review investigated and identified similarities and differences between the various CCEs and thereafter with the WFME in their prescribed accreditation standards. The main similarities between CCES were found in relation to the structure and terms describing the domain level of accreditation standards. However, differences were noted in the interpretation of those terms. These differences became more pronounced at the component descriptive level. These included differing intended purposes of the mission statement, standards for faculty staff, requirements for clinical training by students, program budgetary autonomy and transparency, the need for chiropractic philosophy and history, and which subjects should be taught in basic, behavioural and clinical sciences. Consequently, a series of recommendations were made in an attempt to bring parity between CCEs' educational standards and best medical international practice (Table 6). The adoption of these has the potential to create a homogenised, internationally consistent, and high quality set of accreditation standards.

Differences were also found in relation to the WFME, mainly in relation to the scope of the mission statement, levels of qualifications of faculty, the balance of research, teaching and service for academic staff, and that evidence-based healthcare be taught throughout the curriculum.

Variations in international accreditation standards may be influenced by CCEs differences in enforcement standards. This suggests the need for studies defining similarities and differences of chiropractic program self-evaluation reports and rejoinders to CCE responses, CCE accreditation/inspection team reports, and final reports of findings.

Recommendations

Table 6 Summary table of recommendations

	Recommendations in relation to educational standards	Justifications
Recommendations for definitions of "Educational Standard"		
1.	All CCE documents should contain a definition of the term "educational standard" and it should provide enough profession-specific detail to be professionally useful for chiropractic programs.	Chiropractic educators would better understand the concept of an educational standard if it was detailed and can thus more easily meet the required standards
Recommendations for the domains of Educational Standards		
3.	Add the domain "distance education" to educational standards	Quality of content and assessment of on-line material should be standardised to ensure uniform and high quality standards.
Recommendations for the subdomains of Educational Standards		
4.	Perform a literature review for empirically based methods to successfully formulate and implement a mission statement	Make it easier to prescribe and provide an effective mission statement
5.	Include comprehensive and specific terminology for identifying and explaining the purpose of the mission statement	Educators should have a clearly defined goal in order assist them build a quality program
6.	All appropriate stakeholders should be considered and listened to in the developing of mission statements	Aligns chiropractors with societal needs and expectations
7.	Chiropractic programs mission statements should include a social responsibility.	Also aligns chiropractors with societal needs
8.	The clinical aspect of chiropractic programs should take place partly in hospitals	To provide an appropriate patient case mix exposure for chiropractic students
9.	There should be a minimum set of financial standards in accord with best international business practice	To ensure the long term survival of the course and protection of students and staff.
10.	Chiropractic program staff must include people with PhD degrees.	To improve the educational standing of chiropractic education.
11.	CCEs should encourage research to inform educators of the optimal number of patient numbers, hours or competencies required for student training	To increase the likelihood that graduates achieve the highest levels of competence
12.	There should be a requirement for multimodal learning in curricula	To improve students' learning outcomes
13.	CCEs should encourage research into which types of learning work best for specific subjects for chiropractic students	To maximize the teaching/learning situation as much as possible
14.	CCEs should help identify the "core" material required for chiropractic graduates	To economize time at its maximum and keep updated on scientific changes and developments in clinical practice

Abbreviations
CCE: Council on chiropractic education; USA: United States of America; WFME: World Federation for medical education

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Authors' contributions
SI, BW and CLY were responsible for the study design. SI undertook the data analysis and interpretation. SI developed the initial and iterative draft. BW and CLY were responsible for reviewing and redrafting the final manuscript. All contributed to the final version. All authors read and approved the final manuscript.

Competing interests
Bruce Walker is Editor-in-Chief and Charlotte Leboeuf-Yde is Senior Editorial Adviser of the journal *Chiropractic & Manual Therapies*. Neither played any part in the assignment of this manuscript to Associate Editors or peer reviewers and are separated and blinded from the editorial system from submission inception to decision. Bruce Walker is Head of the CCE-Australasia accredited chiropractic program at Murdoch University in Perth, Western Australia and a Board member of the CCEA, Charlotte Leboeuf-Yde is a member of the European Council on Chiropractic Education Council of Accreditation.

Consent for publication
Not applicable.

Ethics approval and consent to participate
This study was an analysis of freely available website content and did not involve collecting data from human participants, hence ethics approval was not required.

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Study: How comprehensively is evidence-based practice represented in CCE educational standards: a systematic audit.

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RESEARCH Open Access

How comprehensively is evidence-based practice represented in councils on chiropractic education (CCE) educational standards: a systematic audit

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Abstract

Background: The incorporation of evidence-based practice (EBP) is widely recognised as a necessary process for entry-level health professional training. Accreditation documents reflect the practice standards of health professions. No previous study has assessed the extent to which EBP has been taken up by chiropractic regulatory/licencing authorities, known as Councils on Chiropractic Education (CCEs), around the world. The purposes of this study were to examine CCEs' educational standards for signs of a positive and negative approach to EBP as indicated by the prevalence and use of the words *evidence, research, subluxation* and *vitalism*, and to make recommendations if significant deficiencies were found.

Method: We undertook a systematic audit of the educational standard documents of the various CCEs. CCEs were selected on the basis of the World Health Organisation. Two investigators identified the occurrences of terms explicitly related to EBP: evidence, evidence-based, research, subluxation and vitalism. This information was tabulated for comparative purposes. The date of the study was March 2016.

Results: Occurrences of the term *evidence*, as it related to EBP, was highest in the CCE-Europe ($n = 6$), followed by CCE-Australia ($n = 2$), and CCE-USA ($n = 1$). None were found in the CCE-International or CCE-Canada documents. The term *research* appeared most frequently in the CCE-Europe documents ($n = 43$), followed by CCE-USA (n-32), CCE-Australia ($n = 29$), CCE-Canada ($n = 9$) and CCE-International ($n = 8$). The term *subluxation* was found only once (CCE-USA) and *vitalism* did not appear in any educational standard documents.

Conclusions: Accreditation bodies are powerfully positioned to act as a driver for education providers to give greater priority to embedding EBP into entry-level programs and shaping future directions within the profession. Terminology relating explicitly to EBP appears to be lacking in the educational standard documentation of CCEs. Therefore, future revisions of accreditation standards should address lack of terminology.

Keywords: Evidence-based practice, Accreditation, Chiropractic, Educational standards

Background

Evidence-based practice (EBP) has been defined as "the integration of the best research evidence with clinical expertise and patient values and circumstances [1]" and has been widely supported and adopted across health professions. Responsible practice is generally recognised as needing to be evidence-based because it increases patient safety and makes for more efficient patient care [2–5]. EBP has been shown to reduce hospital length of stay [6], increase survival outcomes [7], improve quality of care [8], enhance data quality and its retrieval [9] and reduce financial cost [6].

Education standards have been shown to impact on the levels of evidence-based practice (EBP) in medicine and medical students' clinical reasoning [10]. The use of EBP has been found to be directly related to the quality of the students' classroom experience and EBP competency has been shown to be influenced by curriculum content such as training in epidemiology, biostatistics and information literacy [10, 11]. Thus maintaining high quality education and training standards with an emphasis on EBP is important for producing competent graduates. A concern is the varying uptake of EBP across health professions. Only half of United States of America (USA) medical specialities required an evidence-based basic science knowledge for accreditation while almost 80 % require proof of demonstration of the use of evidence in practice [12]. This delay in adopting EBP could potentially compromise levels of patient care. It is possible that there is similar slow uptake of EBP in chiropractic education and training with similar consequences such as lower quality of patient care.

Consideration has been given to the international implications of medical educational standards. There is evidence of varying levels of skill in medical practitioners internationally as a result of variable education accreditation standards and the concern has been raised that substandard quality may impact negatively on patient safety and levels of care with an increasingly internationally mobile workforce [13, 14]. The recent release of the World Health Organization international standards for medical education has gone someway to addressing this issue [15]. These standards ultimately intend to improve the health of all peoples. The World Health Organization global standards aim to achieve this by offering a quality template for medical education institutions and programmes for defining institutional, national and regional standards, and as a lever for reform programmes. A study comparing international chiropractic education standards looking for similarities and differences could be used as a foundation for producing a similar template for chiropractic program global standards.

Indicators of evidence-based education standards

Educational standards adopted and monitored by educational regulatory agencies across 11 health profession bodies in Australia were compared in a recent study [16]. The authors compared the frequency of the appearance of EBP-related terms, such as the word *evidencæ*, in documents for informing educational programs of required accreditation standards of the need for EBP. They found that chiropractic documents used *evidence* in relation to evidence-based health care once whereas the most prolific health professions were physiotherapy (8 times), podiatry (5 times), and medicine (4 times). Pharmacy, dentistry and occupational therapy did not mention *evidence* at all. It is noted that McEvoy et al., acknowledged that the frequency of inclusion of EBP-related terms did not necessarily relate to the quality of document [16]. They also recognized that assessment of educational programs included on-site visits, interviews, reviewing of program documentation and curriculum content. However McEvoy et al, concluded that there appeared to be considerable delay in the uptake of language pertaining to EBP that would engender confidence in the adoption of EBP by professional accrediting bodies. Further, these authors state that texts relating to EBP were included infrequently and their relative absence should be rectified in future revisions of accreditation documents.

EBP in chiropractic education

Research has shown that chiropractors are well suited to adopt and enact evidence-based practice guidelines [17, 18]. However, past research has indicated that there is scope for improvement for chiropractors in EBP [19]. Studies have identified barriers such as a lack of research skills and time to learn and adopt EBP [20, 21]. One solution proffered is the implementing of educational interventions shown to improve the use of EBP that have improved levels of patient care in other health disciplines [20]. There is evidence to suggest that adopting EBP in chiropractic education improves an intern's perceived ability to deliver patient care [22]. Suggested remedial actions have included increased adherence to guidelines, appropriate patient advice and spinal manipulation as a first-line or adjunct treatment [19]. While there is no research evidence that regulatory change alter the standards of chiropractic practice, it would seem logical to assume that it is possible to facilitate this process by including EBP as a requirement to educational standards designed and enforced by chiropractic regulatory or licensing agencies. Regulatory and/or licencing bodies for chiropractic programs are known as Councils on Chiropractic Education (CCE). Presently there are four such bodies and each is responsible for chiropractic programs within a discrete geographical location. In addition, there is an international umbrella organisation, the International CCE (CCE-International). A question has been raised as

to whether or not chiropractic educational strategies for the implementation of EBP are being adequately assessed by these agencies [23].

Can research standards impact on EBP?

It would seem quite obvious that research is an important component of EBP and health care training standards. Nonetheless there is evidence to suggest that research is not being targeted sufficiently to inform practice and improve its quality within medicine [24]. Interventions in educational standards by regulatory authorities have been shown to have a positive impact on research in medical education if they (1) protect time for research (2) mandate mentorship and/or collaboration, (3) ensure departmental and institutional commitment and leadership, and (4) are provided with adequate financial support [25]. Consequently accreditation standards should address research, at least across these four areas, for promoting and scaffolding EBP. An audit of CCE standards with respect to the word *research* may provide insight into ways in which EBP is dealt with presently.

The terms "subluxation" and "vitalism"

The word "subluxation" in the chiropractic context has been variously interpreted and defined. One interpretation is that subluxation of the spinal column and other articulations can affect the nervous system function and the expression of health, which may result in symptoms, infirmity and disease [26]. Others use the term to describe a musculoskeletal-based "manipulable lesion" [27]. More recently a large number of chiropractic programs in Europe, South Africa, Australia and Canada became signatories to a position statement on the vertebral subluxation complex as a vitalistic construct [28]. These programs stated that claims that it is the cause of disease is unsupported by evidence. Further, its inclusion in a modern chiropractic curriculum in anything other than an historical context is therefore inappropriate and unnecessary. Other chiropractic educators have stated that use of this term has contributed to a breakdown in communication between chiropractors and other health professionals [29].

This vitalist/subluxation construct is known to often underpin unsubstantiated claims in patient brochures [30], wellness practice based on "vitalism" tenets [31] and anti-immunization views [32]. Based on this position it can be argued that the presence of words such as "subluxation" and "vitalism" in accreditation documentation could be considered a "red flag" for inappropriate standards and be contrary to evidence-based practice.

Comparing chiropractic educational standards internationally

Variable international practitioner profiles have been seen in chiropractic populations [32, 33]. A group of practitioners in Canada were shown to have anti-vaccination beliefs, higher levels of X-ray usage, to be less likely to receive or make referral to or receive referrals from general practitioners, and to utilize specific treatment types, some of which were considered unsuitable [33]. This practitioner profile was found to be related to a cluster of chiropractors who had graduated from certain chiropractic institutions located in the United States of America (USA). Competency standards for graduate-entry level chiropractors devised and enforced by CCEs are not the same everywhere internationally [34]. One possible explanation for these unsuitable profiles is different international standards. To avoid the acceptance of unsuitable practice profiles, as a minimum, one could expect that the CCEs would relate to topics such as evidence and research.

It is believed that a high quality medical education and accreditation system would improve the quality of medical care [35]. Further, generalized quality standards internationally may improve educational program structures and ultimately result in improved standards of care for patients worldwide as well as improved workforce mobility [36]. Studies have been undertaken for medicine with the intent of producing a single relevant robust high quality curricular resource [13–15]. No such study has been undertaken for chiropractic education.

Aim

The aim of this systematic audit was to investigate similarities and differences between the standards provided by various CCEs in their use of words that relate to EBP, both positively and negatively. A broader examination of other key terms in educational standards will be the subject of future research.

Objectives

The objectives were to examine CCEs' educational standards for signs of a positive and negative approach, respectively to EBP as indicated by the prevalence and use of the words

1. Evidence
2. Research
3. Subluxation
4. Vitalism, and
5. to make recommendations if significant deficiencies were found.

Method

A systematic audit of current educational standards was undertaken for the CCEs who are currently recognized by the World Health Organization [37]. This included the CCE-Australia, CCE-Canada, CCE-Europe, CCE-USA and CCE-International. The educational standards

were downloaded from their respective websites as PDFs at the time of the study (March, 2016). This study was an analysis of website content and did not involve collecting data from human participants, hence ethics approval was not required.

The systematic audit consisted of three phases:

(a) searching for the words *evidence, research, subluxation, and vitalism* in the respective educational standards
(b) determining if the term was related to education/training
(c) tabulating the results for each CCE to establish any similarities and differences.

The first phase of the audit aimed to locate the specified words of interest. The PDF texts were searched using the full reader search in Adobe Reader (XI). All occurrences of the word were copied verbatim and extracted into a spreadsheet by two of the authors (SI and CL-Y). Disagreements were resolved by discussion; a third author was available if a word categorization could not be agreed upon.

The second phase of the audit aimed to determine the frequency of the use of the word in a manner that indicated if it was being directed toward training or educational standards. For example the term *evidence* was searched for to ensure that variations of the full phrase, such as EBP or EB health care, were not missed. The level of the use was then determined by following the categorization of "heading", "text" or "other". A "heading" was determined to be a first heading in larger font or bold indicating a section of information. "Text" was allocated when the word was found within a sentence describing a standard. "Other" was used when the word was related to an irrelevant context eg, "a program should provide evidence of financial records for the past 3 years". Thereafter the frequency of use was established for each word and category.

In the third phase of the audit, the extracted spreadsheet was limited to the "text" words. Common themes in the sentences which the word appeared were identified. Lists were created under identified common themes. These were then compared across all CCEs for similarities and differences.

This process was repeated for the words *research, subluxation* and *vitalism*.

Results

There were no disagreements on word categorization between the two authors during the extraction process.

Objective One: the word *"evidence"*

Across the five CCEs, the word *evidence* appeared 85 times with nine of these being specific to EBP or health care (Table 1). This ranged from zero to six times in individual CCE documents. The term *evidence* did not appear in any major headings. *Evidence-based* appeared most frequently in the CCE-Europe educational standards ($n = 6$) followed by CCE-Australia ($n = 2$) and CCE-USA ($n = 1$). CCE-Canada and CCE-International made no mention of *evidence-based* practice or *evidence-based* health care.

The CCE-Europe expected programs to teach EBP and the best use information technology in this process. The standards for the CCE-Europe stated that evidence should inform knowledge and principles of practice and keep the curriculum up to date. Documents from the CCE-Australia standards were found to have the requirement that information technology should be part of the education for *"Evidence-based health care"*. The second occurrence in the CCE-Australia standards was for the principles of *"Evidence-based health care"* to be taught throughout the curriculum. The CCE-USA expected students to be introduced to the value of EB scientific thinking.

Objective Two: the word *"research"*

Across the five CCEs, the word *research* appeared 147 times (Table 1). Of these, 121 were embedded within the educational standard documents as prescriptive text defining research with chiropractic programs. This ranged from eight to forty three times in individual documents. Research appeared most frequently in the CCE-Europe educational standards ($n = 43$) followed by CCE-USA ($n = 32$) CCE-Australia ($n = 29$), CCE-Canada ($n = 9$) and finally CCE-International ($n = 8$). The term *research* was classified as "other" three times.

Table 1 Frequency of words "evidence" "research" "subluxation" in CCE Educational Standards

Word		Evidence			Research			Subluxation		
	Total document word count	Heading	Text	Other	Heading	Text	Other	Heading	Text	Other
CCE-Australia	6932	-	2	14	7	29	1	-	-	-
CCE-Canada	15,200	-	-	40	6	9	-	-	-	-
CCE-Europe	16,610	-	6	20	5	43	-	-	-	-
CCE-Int	2724	-	-	5	1	8	1	-	-	-
CCE-USA	12,445	-	1	56	4	32	1	-	1	-

All CCEs stated that programs should train students to be good consumers of research by teaching them how to acquire, appraise and apply evidence within an environment that encourages research". Further it was commonplace for CCE educational standards to state that students should be trained in research methods and be given the opportunity to become producers of research by conducting research projects. All CCEs expected adherence to high standards of research conduct and ethics.

However, differences emerged over the scope of research (Table 2). Two CCEs adopted the position that research should be focused on the field of chiropractic. Others did not limit it to any particular area or discipline. In contrast two CCEs specified the need for it to be conducted with other health sectors. Only one of the CCEs' educational standards expected programs to provide opportunities for students to progress to post graduate research. Two of the five CCEs required research to inform chiropractic practice and three required it to inform education and teaching. Finally, only two of the five CCEs expected programs to provide research active staff to supervise and teach students.

Objectives three and four: the words "subluxation" and "vitalism"

The word "Subluxation" was found only once (CCE-USA standards). It stated that chiropractic education programs should train its graduates to *"assess and document a patient's health status....including subluxation/neuro-biomechanical dysfunction (pg 11 Educational Standards USA)"*.

"Vitalism" was not found in any of the CCE documents.

Discussion

This study was the first to systematically audit all CCE Education Standards for indicators of EBP and/or EB health care using keywords that were indicators of the adoption of EBP and others that indicated a non-adoption. Although we found only some references to the key words indicative of the presence of EBP it was encouraging that the keyword "subluxation", which we considered an indicator of an inconsistent or incomplete adoption of EBP was found only once and that "vitalism", in our opinion, also an indicator of non-adoption of EBP was absent in these standards.

Table 2 Comparison among CCEs of use of the term *research*

Research statement	CCE-Aust	CCE-Can	CCE-Euro	CCE-Int	CCE-USA
Must teach research inquiry & scientific method	X	X	X	X	X
Processes/policy that recognises, develops, supports staff research	X		X		X
Establish research programs	X	X	X	X	X
Provide adequate time/space/finances/resources	X		X		X
Create an environment which encourages/facilitates research	X	X	X		X
Adhere to ethics/highest standards of research conduct	X	X	X	X	X
Written policies protecting human/animal subjects	X	X		X	X
Staff development to include research	X		X		X
Research must inform chiropractic practice			X		X
Research must inform/interaction with education/teaching	X		X		X
Evidence its contribution to body of research	X	X			X
Establish objectives for research		X			X
Students to conduct research projects	X		X	X	X
Students trained in research methods	X	X	X	X	
Students to be encourage & prepare for engagement in research	X		X		x
Students have post grad research opportunities	X				
Encourage students to gain research experience	X		X		X
Compile evidence of contribution to profession	X	X		X	x
Provide research active staff who supervise students			X		X
Research with other health sectors			X	X	
Must research the field of chiropractic		X		X	
Be meaningful research & highest possible quality					X

"X" denotes the presence of the word research in the CCE educational standards in the specified context

Of the five chiropractic regulatory bodies only the CCE-Europe and CCE-Australia contained statements requiring an EB approach to be taught throughout the curriculum. The CCE-USA's only mention was the expectation that students should be introduced to scientific thinking. The support for EBP with the use of explicit terms was generally disappointing in the CCE educational standards. These documents have the potential to act as drivers for education providers to embed EBP into practice [16]. EBP has been shown to influence educational, entry-level graduates and practitioner levels of care which in turn has improved patient outcomes [38]. By extension there can be little justification for anything other than active support for the inclusion of explicit language detailing an EB approach.

Nevertheless, the word research was more widely included in CCE educational standards. There appears to be uniform agreement that research is a core component to CCE educational standards. This as reflected in the common statement that research should be established, resourced, and taught in programs. This reflects the view that programs should be, at a minimum, producing skilled clinicians who are competent consumers of research through teaching basic skills of EB medicine [39]. This "consumer of research" level of training, an ability to evaluate evidence, has been shown to be an important element of clinical competence [40]. However, some view research as a separate educational component or subject, like anatomy or physical diagnosis. Others perceive research as something which is foundational to the entire program. For example the CCE-Europe and CCE-USA see research as informing chiropractic practice, education and teaching. Interestingly, two of the CCEs (Europe and International) required research to be conducted with other health sectors, indicating a desire for collaboration, and thus integration, with the broader health care community.

Medical educators believe that evidence-based education is not possible without adequate research support and funding [41]. Likewise the present authors, and others, believe that if chiropractic education and the profession is to continue to establish itself as a credible and mature health profession then there needs to be an emphasis on not just training skilled consumers of research but also on facilitating increased numbers of the producers of research ie, the number of post graduate researchers and research active academics within chiropractic programs [42, 43]. This attitude or path is not reflected in all CCE documents. A single CCE required post graduate opportunities to be provided for students and only two CCEs stated that research active staff should be provided to supervise research students. These two provisions are examples of changes that could be implemented in all CCE educational standards, if monitored and enforced, to facilitate the increased adoption of research to scaffold EBP.

As previously mentioned the leaders of a large number of chiropractic educational programs have signed the "Clinical and Professional Chiropractic Education: a Position Statement" [28]. They describe *subluxation* and *vitalism* as being unsupported by evidence. *Subluxation* was found once whereas *vitalism* was not found in this audit. The CCE-USA adopted the position that chiropractic programs should train their graduates to be able to detect *subluxations*. This raises several questions. Should a non-evidence based construct like subluxation be mandated to be taught in an educational program via educational standards? Some chiropractic educators have made a decision not to teach *subluxation/vitalism*, other than as a historical concept, because of a lack of evidence. Should educators be supported in this evidence-based approach by regulatory/licencing agencies actively promoting the non-teaching of subluxation/vitalism by making specific mention of its appropriate context in CCE educational standards? The absence of the words *subluxation* and *vitalism* may be interpreted as either a reluctance of regulatory bodies to actively prescribe against the use of this non-evidence based agenda from chiropractic programs or that these terms are out dated, historical and of no current importance. We contend that silence on these matters is inappropriate and could open the door to chiropractic practice programs teaching a doctrinal dogma unsupported by evidence.

Strengths and limitations

This was a comprehensive audit of the available educational standards for the CCEs recognized by the WHO. All public domain material was scrutinized. The screening method was automatic and the authors remain confident that they have found the terms and appropriately classified them according to "heading, text or other". The search for other terms, however, could perhaps have resulted in other findings and conclusions.

It should also be borne in mind that the frequency of terms does not necessarily relate to the quality of the document. We did not include competency standards as this was studied in a previous paper [34]. Also we recognize that program evaluation extends beyond these documents alone and requires an extensive self-evaluation, inspection and review process. However, the contents of these standards are clearly the foundation for such evaluations, and are therefore important documents to scrutinize.

Conclusion

Educational standards have the potential to act as initiators and promoters of quality educational programs by improving the competency of entry-level graduates.

Relevant terms used in these documents have the potential to clearly specify what standards educators should and can teach and use for training. CCE choice of specific vocabulary in relation to evidence-based practice in their accreditation documents has been slow and incomplete in the uptake of contemporary evidence-based trends. The absence of malevolent terms such as "subluxation" and "vitalism" and firm statements about their undesirability may provide opportunities for aberrant chiropractic programs to be accredited. Future revisions of accreditation standards should address this.

Abbreviations
CCE, council on chiropractic education; EBP, evidence-based practice; USA, United States of America

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Authors' contributions
All authors read and approved the final manuscript. SI, BW and CLY were responsible for the study design. SI and CLY undertook the data analysis and interpretation. SI developed the initial and iterative draft. BW and CLY were responsible for reviewing and redrafting the final manuscript. All contributed to the final version.

Competing interests
Bruce Walker is Editor-in-Chief and Charlotte Leboeuf-Yde is Senior Editorial Adviser of the journal *Chiropractic & Manual Therapies*. Neither played any part in the assignment of this manuscript to Associate Editors or peer reviewers and are blinded from the editorial system from submission inception to decision. Bruce Walker is Head of the CCE-Australia accredited chiropractic program at Murdoch University in Perth, Western Australia and CLY is a member of the European Council on Chiropractic Education Council of Accreditation.

Consent for publication
Not applicable.

Ethics approval and consent to participate
This study was an analysis of freely available website content and did not involve collecting data from human participants, hence ethics approval was not required.

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Study: Comparing the old to the new: A comparison of similarities and differences of the accreditation standards of the CCE-International from 2010 to 2016.

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RESEARCH Open Access

Comparing the old to the new: A comparison of similarities and differences of the accreditation standards of the chiropractic council on education-international from 2010 to 2016

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Abstract

Background: Chiropractic programs are accredited and monitored by regional Councils on Chiropractic Education (CCE). The CCE-International has historically been a federation of regional CCEs charged with harmonising world standards to produce quality chiropractic educational programs. The standards for accreditation periodically undergo revision. We conducted a comparison of the CCE-International 2016 Accreditation Standards with the previous version, looking for similarities and differences, expecting to see some improvements.

Method: The CCE-International current (2016) and previous versions (2010) were located and downloaded. Word counts were conducted for words thought to reflect content and differences between standards. These were tabulated to identify similarities and differences. Interpretation was made independently followed by discussion between two researchers.

Results: The 2016 standards were nearly 3 times larger than the previous standards. The 2016 standards were created by mapping and selection of common themes from member CCEs' accreditation standards and not through an evidence-based approach to the development and trialling of accreditation standards before implementation. In 2010 chiropractors were expected to provide attention to the relationship between the structural and neurological aspects of the body in health and disease. In 2016 they should manage mechanical disorders of the musculoskeletal system. Many similarities between the old and the new standards were found. Additions in 2016 included a hybrid model of accreditation founded on outcomes-based assessment of education and quality improvement. Both include comprehensive competencies for a broader role in public health. Omissions included minimal faculty qualifications and the requirement that students should be able to critically appraise scientific and clinical knowledge. Another omission was the requirement for chiropractic programs to be part of a not-for-profit educational entity. There was no mention of evidence-based practice in either standards but the word 'evidence-informed' appeared once in the 2016 standards.

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Conclusions: Some positive changes have taken place, such as having bravely moved towards the musculoskeletal model, but on the negative side, the requirement to produce graduates skilled at dealing with scientific texts has been removed. A more robust development approach including better transparency is needed before implementation of CCE standards and evidence-based concepts should be integrated in the programs. The CCE-International should consider the creation of a recognition of excellence in educational programs and not merely propose minimal standards.

Keywords: Accreditation, Critical review, Chiropractic, Education, Standards

Background

Governments encourage, directly and indirectly, a range of strategies to regulate, monitor and improve the organization, management, quality, and safety of health services. One of these strategies is the accreditation of health training programs, which are now employed in over 70 countries [1, 2]. Accreditation is perceived to be one lever to stimulate systems-level improvement by promoting uptake of optimal, evidence-based governance and clinical standards [3].

Following this model, the role of the Councils on Chiropractic Education (CCEs) is to oversee the regulatory standards of chiropractic education worldwide. Such CCEs are found in Australia (CCE-Australasia), Canada (CCE-Canada), Europe (European-CCE), and in the USA (CCE-USA).

In 2003 an international umbrella council, known as the Council on Chiropractic International (CCE-International) was established as a federation consisting of representatives from the four previously mentioned CCEs. The various CCEs developed a list of the minimum expectations for standards that they could agree upon. In part, this was influenced by the differing types of authorization that some CCEs were themselves subject to. This list was adopted as the Accreditation Standards for the CCE-International, with the intent of harmonising world standards for excellence in chiropractic educational programs [4]. The CCE-International is importantly and strategically placed to guide chiropractic education, given it is recognised by the World Health Organisation as the source of information regarding the evaluation of chiropractic education [5]. The CCE-International is not an accrediting agency per se. Rather, the CCE-International has historically provided guidance and support for its four members and others wishing to join the CCE-International on appropriate educational standards and accreditation processes for the achievement of high quality education by chiropractic programs. Presently however, it appears that the CCE-USA has withdrawn from this collaboration as it is no longer listed as a member of the CCE-International on its website and is recorded as being a CCE-International member agency in the 2016 Glossary section between 2001 and 2016 [6]. We could find no official statement from the CCE-International on this change nor did we have a response to a written enquiry confirming the change and any attendant reasons for it. A written enquiry was sent to the CCE-USA seeking their reasons for withdrawal from the CCE-international. The CCE-USA declined to respond as the notification and reasons for termination of membership was communicated to the CCE-International and as such was a confidential communication between two parties. Consequently disclosure was at the discretion of the CCE-International (Email to CCE-USA (cce@cce-usa.org) January 2018).

The CCE-International standards and processes generally consist of several components including among other things an expectation for adequate physical resources, such as buildings, staff and finances. Also defined is a set of competencies a student should acquire before graduation. Regulatory agencies expect that the program curriculum will be designed to achieve a specified set of knowledge proficiencies, skills and abilities. This aims at guaranteeing that chiropractors achieve a similar basic standard, regardless where in the world they obtain their education. The attainment of the set competencies and standards is intended to ultimately improve the quality of societal levels of health care and patient safety. Finally, these standards define the processes for initial accreditation as well as re-accreditation with the aim of providing a process that leads to continual improvement of the program.

Juxtaposed against these ideals is the reality of elements of undesirable chiropractic standards of practice in the wider community documented over the past ten years, where it has been argued that this conduct may be associated with variations between chiropractic programs [7–9]. These undesirable practices include negative vaccination beliefs, excessive X-ray usage, non-evidence-based treatment choices and the infrequent referral to or from other health care providers [7, 9]. These undesirable activities have been described as being in contrast to current scientific paradigms, such as evidence-based practice, and aligning with scientifically unorthodox/subluxation or vitalist model [7]. It is not unreasonable to expect that CCE requirements would therefore include elements that

counteract the teaching of undesirable practice patterns, such as a non-evidence approaches to care. However, this may not be the case as recent studies have compared international chiropractic accreditation standards and graduate entry-level competencies and found considerable variation between them [8, 10, 11].

Government agencies frequently engage in the development and revision of accreditation standards [12]. It is logical to assume that such revisions are intended to improve the standards and processes with the ultimate outcome of improving graduate abilities and thus public health and safety. It is also logical to assume that revisions are based on responses to practice patterns, both desirable and undesirable, and their trends in different parts of the world. The acquisition of such information from a variety of stakeholders is widely recognised as being a foundational component for the construction of accreditation standards to ensure they are socially responsible [13].

Therefore, one would expect to see a positive incremental change in these domains over time. To date this type of change has not been studied for CCEs. Instead of investigating such changes in each CCE on its own, it is appropriate to scrutinize the CCE-International, as it is expected to broadly reflect the CCE standards world-wide. In addition, it is independent of any regulatory authority and is responsible for the development of its own standards, thus truly reflecting leadership and the intentions of the educational community within the chiropractic profession.

Objectives

The objectives of this review were (i) to compare the Council on Chiropractic Education International 2016 Accreditation Standards with their previous 2010 Accreditation Standards, including the way they were developed, and (ii) to explore similarities and differences of prescribed recommendations to identify any changes to procedures, concepts and emphases. And, finally, (iii) to comment on whether these changes are likely to be for the better or the worse.

Methods

We conducted a systematic investigation into the first two objectives. This initially involved a critical look at the development process, followed by a comparison of the themes covered in the CCE-International Accreditation Standards from 2010 and 2016. This was followed by a comparison of the content of the two documents looking for similarities and differences. As part of the analysis we counted pre-selected key words and compared them for increased or decreased frequency of usage. We were particularly interested in how the topic of evidence-based teaching would be covered and how an evidence-friendly culture would be developed, as an important aspect of modern health-care education and delivery.

Data extraction process and synthesis of results

The CCE-International website was searched for the current Accreditation and Educational Standards.

The current CCE-International Framework for Chiropractic Education and Accreditation was downloaded in March 2017 [4] and the publication approval date was identified as June 2016. The publication date of the previous CCE-International standards could not be determined from the CCE-International website. An email in April 2017 was sent via the CCE-International server requesting this information. No response was received. A web library [14] was used to search CCE-International website history to find information about the date for the previous standards, which was found to be November 2010. This matched information used in a prior study [15].

The PDF texts of the downloaded 2010 and 2016 CCE-International standards were converted to Microsoft Word format. The Word documents were compared to the PDF texts to ensure that no errors had occurred. The 2016 standards were structured into 4 sections (themes): Introduction/Foreword, Standards, Competencies, and Processes.

Accordingly, we divided all information from the 2010 standards into individual components and then arranged them to match the four sections of the 2016 standards. This allowed for direct comparison of similarities and differences in a Microsoft Word document.

A comparison of contents was made by counting words in the two documents. The "Glossary" section of the 2016 standards was not included in the word count as there was no equivalent section in the 2010 standards and it only contained definitions of words and the rationale for their use. Content analysis using word counting is widely used in qualitative research [16–18]. A summative content analysis involves reading the data several times for familiarisation to provide the opportunity to reflect on the overall meaning. The data was then coded and compared, usually for keywords or content and generally tabulated [18]. This process was to facilitate the subsequent interpretation of the underlying context. After this process, the lead researcher identified sixty-seven predominately adjectival words, seen in Table 3, considered to reflect the content and intent of the educational standards. These words related to the administration, teaching, or practice of chiropractic as well as the assessment of a chiropractic program (CP). The lead author (SI) then searched for each word using the 'Find' function in Microsoft Word. All occurrences of the word were copied verbatim, including the sentence in which it was found so it could be seen in its context, and listed in a spreadsheet. These final list was

reviewed and discussed with another of the authors (CLY).

The second phase of the investigation determined the frequency of the use of each word and whether it was being directed toward the student, the CP, was a heading (in larger font or bold indicating a section of information) or if it had another unrelated purpose. The context or intent of the use was then determined by following the categorization of 'heading', 'student', 'CP' or 'other'. For example, the word 'respect' was searched for in the 2016 standards. It occurred as an expectation that a student would "respect the cultural diversity of patients" (classified as 'student'), and that the accreditation process would "respect the autonomy of the CP" (classified as 'CP'), and that there was a need to "meet CP objectives with respect to student criteria" and therefore classified as 'other'. Thereafter the frequency of use was established for each word and category. Uncertainty over the intent of any word was discussed with the second author (CLY). Any disagreement between the two authors was resolved by discussion with the third author (BW).

In the final phase, the extracted spreadsheet was visually examined for an increased, decreased or unchanged frequency of the occurrence of the words when compared across CCE-International standards for 2010 and 2016.

Results

There was a high degree of agreement between the two researchers on the classification of the similarities and differences and the context of the prescribed key words. The third researcher was therefore not required to resolve any disagreements.

General impressions

The documents contained the same number of sections although these were labelled differently. In general, more descriptive detail was added to each section in the newer version, making the 2016 CCE-International Accreditation Standards 2.7 times larger than the 2010 standards, (7042 words versus 2280 words, respectively not including Foreword/Introduction sections).

The four sections were:

1. Foreword (2010 standards) 421 words, Introduction (2016 standards) 701 words.
2. Educational Standards (2010) 468 words, Program Standards (2016) 2005 words.
3. Educational Objectives (2010) 471 words, Competencies for Graduating Chiropractors (2016) 1540 words.
4. Process of Accreditation (2010) 799 words, Accreditation Policies and Procedures (2016) 3341 words. This large difference is due to the 2016 standards containing an additional section for Reaffirmation of Accreditation (1656 words).

Both standards provide a definition of chiropractic (Table 1). The 2016 accreditation standards have adopted the definition of the World Federation of Chiropractic (WFC) [19] whereas the 2010 standards' definition is unreferenced. The adoption of the WFC definition has resulted in a narrowing of the scope from "giving particular attention to the relationship of the structural and neurological aspects of the body in health and disease" to "the diagnosis, treatment and prevention of mechanical disorders of the musculoskeletal system".

Method of development of new standards

According to the 2016 Standards' 'Development process' section, the standards were initially developed by a mapping of common themes with a computer software qualitative research program (NVivo) of the 4 member CCEs. In 2014 and 2015 a Steering Committee with representatives from each of the four member agencies met to critically review the draft framework. The members of the Steering Committee are named along with their membership affiliations but their qualifications and expertise to perform this task are not. The CCE-International Board was said to have approved progress at a number of 'key stages' throughout this process. In April 2015, the draft framework went through a consultation process with the four CCE-International member agencies (participants and qualifications not named). A second round occurred in November 2015. This was described as being with stakeholders 'more broadly', but the identity of these stakeholders, their qualifications, or expertise is not described.

Table 1 Comparison of definitions of chiropractor/chiropractic used in the 2010 and 2016 Council on Chiropractic Education – International Accreditation Standards

Standards	Definition of Chiropractor
2010	The chiropractor, as a practitioner of the healing arts, is concerned with the health needs of the public. He/she gives particular attention to the relationship of the structural and neurological aspects of the body in health and disease; he/she is educated in the basic and clinical sciences as well as in related health subjects. The purpose of his/her professional education is to prepare the chiropractor as a primary health care provider. As a portal of entry to the health delivery system, the chiropractor must be well educated to diagnose, to care for the human body in health and disease and to consult with, or refer to, other health care providers when appropriate for the best interest of the patient. (Pg 1)
2016	'A health profession concerned with the diagnosis, treatment and prevention of mechanical disorders of the musculoskeletal system, and the effects of these disorders on the function of the nervous system and general health. There is an emphasis on manual treatments including spinal adjustment and other joint and soft-tissue manipulation.' (Pg 17)

At each stage feedback was 'considered' and incorporated by the Steering Committee and a final decision of approval was made by the CCE-International in June 2016.

No information could be found regarding the conception of the 2010 CCE-International Standards.

Foreword section of the accreditation standards in 2010 versus 2016

Similarities: These CCE-International standards are stated to constitute a minimum requirement for chiropractic program (CP) accreditation. Any CCE seeking membership to the CCE-International is expected to adopt and meet these standards.

Both 2010 and 2016 versions recognise the need to accommodate cultural and regional differences (Table 2).

Differences: None were found.

Program standards (educational standards in 2010 versus 2016)

Similarities: The 2016 and 2010 standards share domains that address student policies, competencies, and assessment of performance and the educational program. Also shared are the requirements for adequate physical facilities, faculty, support staff, research, scholarship, clinic and learning resources. CPs are expected to be ethical and their advertising and marketing should reflect integrity in all matters. In addition, the program standards should meet local judicial and legal requirements.

Other commonalities are that mission, objectives and goals should be clearly stated for each CP. There must be financial transparency and enough resources in order for the most recently enrolled students to be able to graduate. The appropriate overseeing governing body of the CP should be allowed to act with autonomy. Input is expected from faculty, staff, students, patients, and appropriate others. Finally, there should be logic and structure to the curriculum that must be scaffolded with appropriate pedagogy and resources in order to achieve the CP objectives.

Differences:

Added:

The 2016 standards have moved to a hybrid model of outcomes-based education alongside self-assessed quality improvement. This means that each CP must provide an educational environment and curriculum as well as monitor and evaluate the effective acquisition of the knowledge, skills and attitudes needed to achieve the exit outcomes as described by competencies for graduating chiropractors. These must be clearly communicated to all concerned. Considerably more detail than before is provided for appropriate Governance and Administration.

The CP must regularly publish an academic calendar/catalogue, bulletin or similar document. This document should contain information for current and potential students that is accurate and relevant.

Other additions include standards for 'information and communication technology' and service to the program. The 2016 standards contain the additional expectation that patient care should be "evidence-informed" and should incorporate quality assurance. There was no mention of evidence-based care at all in the 2010 document nor was it explicitly mentioned in the 2016 version.

Staffx/faculty must be engaged in research and scholarship, service, professional development and governance activities as well as undergo regular performance reviews. The planning, goals and objectives of research should support the CP mission and facilitate the relationship between teaching and research. Faculty should be qualified by virtue of their academic and professional training and experience and/or their credentials to be educators.

Omitted:

Removals from the 2016 standards include the requirement for stable academic staff and that clinical staff should have as a minimum 3 years fulltime practice or 2 years teaching experience and be registered. CPs are no longer required to operate as, or as part of, an institute established as a not-for-profit educational entity.

Competencies/educational objectives

Similarities: Shared are the standards for a competent clinical encounter with a patient; a foundational knowledge, clinical skills as evidenced by the ability to formulate a diagnosis, implement treatment whilst demonstrating communication skills, a quality chiropractor-patient relationship, professionalism, and inter-professional collaboration.

Differences:

Added

The focus of the standards has remained on chiropractors serving as primary contact practitioners and a portal of entry into health care but the standards now also include the need to perform tasks safely and effectively in a specific workforce setting.

The clinical skills domain has been expanded to include the need for a developed management plan and its monitoring as well as appropriate informed consent which includes treatment risks, benefits, natural history and alternative treatment options.

A domain for inter-professional collaboration has been added along with the need to be able to recognize the limits of individual and professional knowledge and competence.

There are now also expectations for inclusion of psychosocial factors in patient assessment and interventions. The appropriate and effective delivery of care has been expanded to include interventions other than spinal manipulation. Finally, chiropractors are expected

Table 2 Comparison of CCE-International Accreditation / Educational standards 2010 and 2016

Domain and subdomain	2010	2016
Introduction/Foreword		
Definition of Chiropractor	Self-defined	Use of the definition by the World Federation Chiropractic
Areas must address	X	X
Recognition of cultural variations	X	X
Intention to be used as reference	X	X
This is a minimum standard	X	X
1. PROGRAM STANDARDS		
Based on model of outcomes-based education		X
CCE must monitor exit outcomes		X
Exit outcomes must be explicit		X
Must be communicated to all stakeholders		X
Curriculum must achieve educational outcomes		X
Monitor & evaluate curriculum effectiveness	X	X
Goals		X
Must define its mission, measurable goals & objectives		X
Mission must incorporate		X
Instruction / learning		X
Patient care		X
Research & scholarship		X
Service		X
Participation-consult with principal stakeholders		X
Autonomy to develop own program		X
Ethics, integrity & accountability	X	X
Governance		X
Governing board		X
Governing structures		X
Academic leadership		X
Faculty participation		X
Student input		X
Administration		X
Evaluation & quality improvement		X
Patient care		X
Educational budget & resource allocation	X	X
Educational Program	X	X
Curriculum model & educational methods	X	X
Curriculum development & assessment		X
Curriculum structure & content	X	X
Faculty		
Minimal Qualifications		X
Students	X	X
Student admissions		X
Disclosure to students		X

Table 2 Comparison of CCE-International Accreditation / Educational standards 2010 and 2016 *(Continued)*

Domain and subdomain	2010	2016
Student support services		X
Student policies	X	X
Student competencies	X	X
Assessment of student performance	X	X
Research & Scholarship	X	X
Resources	X	X
Physical facilities	X	X
Clinic resources	X	X
Learning resources	X	X
Information and communication technology		X
Service		X
2. COMPETENCIES		
Definition Competence	X	X
Definition of Standard	X	X
Foundational knowledge	X	X
Clinical skills	X	X
Formulate a differential diagnosis	X	X
Develop & evolve a management plan		X
Implement & monitor treatment		X
Evaluation of progress		X
Professionalism		X
Ethics & jurisprudence		X
Record keeping		X
Communication skills	X	X
Chiropractor-patient relationship	X	X
Inter-professional collaboration	X	X
Health Promotion & disease prevention	X	X
3. PROCEDURES		X
Initial Accreditation		X
Reaffirmation of accreditation		X
Confidentiality		X
1. Initial application for accreditation		X
Letter of intent		X
Eligibility criteria	X	X
Evidence of eligibility	X	X
Self-evaluation report (SER)	X	X
Decision about SER	X	X
Site team visit	X	X
Joint activities in accreditation process		X
Site team report		X
Final decision to ward accredited status		X
Award of Accredited status		X
Deferral of accreditation		X

Table 2 Comparison of CCE-International Accreditation / Educational standards 2010 and 2016 *(Continued)*

Domain and subdomain	2010	2016
Denial of accreditation		X
Notification of decision		X
2. Reaffirmation of accreditation		X
Letter of intent		X
Eligibility criteria		X
SER		X
CCE decision on SER satisfactory / unsatisfactory		X
Site team visit		X
Joint activities in accreditation process		X
Site team report		X
Final decision to ward accredited status		X
Award of Accredited status		X
Deferral of accreditation		X
Impose sanctions		X
Refusal to reaffirm		X
Notification of decision		X
Reaccreditation-reinstatement following refusal		X
Status description		X
Monitoring	X	X
Reports	X	X
Special actions		X
Quality assurance of the CCE for its improvement		X
Complaints and appeals		X
Role of Governance structure of the CCEI member		X
Not included in the 2016 from 2010		
appreciates chiropractic history and the unique paradigm of chiropractic health care	X	
acquires the ability critically to appraise scientific and clinical knowledge	X	
select research subjects, design simple research methods, critically appraise clinical studies and participate in multi-disciplinary research programs	X	
accept the responsibilities of a chiropractor	X	

to become active participants in health promotion and disease prevention for the communities and societies they serve.

Omitted

The 2016 standards do not include the 2010 requirements for the graduate to "appreciate chiropractic history and the unique paradigm of chiropractic health care". Additionally, students are not required to be able to select research subjects, design simple research methods, critically appraise scientific and clinical knowledge, and participate in multi-disciplinary studies. Finally, removed is also the requirement that graduates achieve a level of skill and expertise in manual procedures emphasizing spinal manipulation, regarded as "imperative within the chiropractic field".

Procedures for initial accreditation and reaccreditation

Similarities: The 2010 CCE-International accreditation standards primarily focus on initial accreditation. The standards for reaccreditation are stated as being the same as for accreditation and are regarded in that manner for comparative purposes with the 2016 standards.

Both standards expect the accreditation to begin with notification by the program to the CCE of intent to pursue accreditation. It is expected that the program will have met the specified eligibility criteria stated in the accreditation/education standards.

Once eligibility is established, both standards expect the production of a self-evaluation report. The CCE is empowered to ask questions that may arise from the

self-evaluation report. If this report is deemed satisfactory, then a site inspection is conducted to determine agreement between the report and expected accreditation standards. CPs are to be given the opportunity to address errors of fact before the inspection team report is submitted, as well an opportunity to respond to the final report.

Both standards require the availability of appeal processes for decisions made by the member CCE. The CCE options at the end of the process to award, defer or deny accreditation remain.

Differences

Added:

There should be transparent communication between the CCE and the CP.

All aspects of the accreditation process should be confidential, such as the self-evaluation report, inspection team reports, and the final report and recommendations. All documentation and the self-evaluation report remain the property of CP. This right is waived if the CP publishes any of the accreditation documentation.

The 2016 standards gain an expectation that the inspection site team members should be qualified, although these required qualifications are not specified. CPs have the right to object to the inclusion of a particular inspection team member, if there is a conflict of interest (not specifically defined in the 2016 standard). The site inspection team can fully evaluate all aspects of the program at a mutually convenient time.

In the re-accreditation process, there is an additional option available to CCEs to impose sanctions, although these are not specified. Other variations include the keeping of an up-dated list of accredited programmes on the member CCE website, details for the regular monitoring of programs, and special actions for extraordinary circumstances. Finally, the member CCEs are expected to make themselves available for feedback at the end of the process for quality assurance and continued improvement.

The deferral option, when a CCE requires additional information in order to make a final decision to reaffirm accreditation, is now considered to be confidential. Public notification is required once the decision to award or deny accreditation has been made.

The notification of the final decision regarding (re)accreditation should be provided within 30 days of the final meeting of the CCE and the CP. The CCE is required to publish and maintain the date of the initial accreditation and the length of time it was awarded for on the CCE website. This should also include the year of the next comprehensive site visit. The CCE is expected to keep the decision to impose sanctions confidential and not release this information to the public. There is no requirement for the CCE to publish the reasons why accreditation or reaccreditation was accepted or refused or the strengths or weaknesses of the CP as gathered from the inspection process.

Omitted:

Previously, notification of the accreditation decision should be given to the CP within 90 days, compared to 30 days in the new version.

Word analysis/frequencies (Table 3)

The 2016 CCE-International standards are approximately 3 times larger than the 2010 standards. Consequently, we decided that, at a minimum, a key word should be at least 3 times more or less frequent to warrant inclusion in this section of the analysis. As compared to '0' in the 2010 standards, any positive mention of a new keyword in the 2016 text would be considered relevant.

Words that indicated a more integrated role for chiropractors in the health care system in the 2016 standards were 'collaboration' (0 in 2010 standards and 5 in the 2016 standards), 'inter-professional' (0 vs. 2), 'serve' (1 vs. 4) and 'stakeholders' (0 vs. 8).

Increased number of words indicating an awareness of a broader role for chiropractors was found for 'prevention' (0 vs. 9) and 'promoting' health (2 vs. 9).

Words that suggest a more outcomes-based approach to accreditation of CPs were 'outcomes' (1 vs. 22), 'performance' (3 vs.11), 'evaluate/ing' (12 vs. 32), 'evidence' (5 vs. 24), 'goals' (3 vs. 19), 'effective' (4 vs. 16) and 'compliance' (1 vs. 14).

There appears to be an adoption of more descriptive language for the standards for graduate competencies 'communication/ing' (2 vs. 12), 'competence/tent' (8 vs. 53), 'integrity' (0 vs. 7), 'ethics' (2 vs. 10), 'engages' (0 vs. 4), 'leadership' (0 vs. 11), 'safety' (2 vs. 6) and 'scholarship' (1 vs. 5). Additionally, in the 2016 standards an increase in the word 'patient' (7 vs. 34) may suggest they are more patient focused.

Discussion

Summary of findings

This is the first study to explore changes in CCE accreditation standards over time for indicators of progressive change.

The new and previous standards are similar in that they share the same broad framework for (re)-accreditation, adequate physical structure and staff to reach the CPs mission statement and objectives. They also share the expectation for the attainment of specific competencies that lead to the graduation of a competent chiropractor.

The new standards have provided more descriptive information of all the areas of accreditation and adopted a more contemporary hybrid model of accreditation, combining both outcome-based assessments and quality improvement of the CP [20]. This de-emphasises the

Table 3 The frequency of key words (or their derivatives) in the 2010 and 2016 CCE-International Accreditation Standards

	2010 Standards					2016 Standards				
Word	Total number	Headings	Student	CP	Other	Total Number	Headings	Student	CP	Other
Accountability	1			1		2	1		1	
Accredit	40	14		26		59	10			49
Assessment	2			1	1	13	2	7	4	
Attitudes	1		1			3		3		
Autonomy	0					5	1		4	
Care	18		6		12	36	1	10	4	21
Chiropractic/or	48					191				
Clinical	16		8		8	15	2	13		
Collaboration	0					5	2	3		
Communicate	2		2			12	3	4	5	
Competent	8		8			53	2	39		12 in footnotes
Compliance	1			1		14			14	
Confidentiality	0					2	1		1	
Consult	3		3			2		1	1	
Contra-indication	0					0				
Criteria	0					5	2		3	
Curriculum	8	1		7		20	3		17	
Define	3			3		3	1		1	1 footnotes
Development	7	1		6		7	1	1	4	1
Diagnose	6		6			7	1	6		
Disease	3		3			7	2	5		
Disclosure	0					2	1		1	
Effective	4		2	2		16		6	10	
Engage	0					3		1	2	
Ethic	2		1	1		10	2		8	
Evaluate	12	2		10		32	4		28	
Evidence	5			5		24		1	23	
Facilitates	1		1			2		2		
Faculty	1					14	2		12	
Goal (s)	3	1		2		19	2	1	16	
Identify	2			2		16		7	9	
Indicate	2			2		3		2		
Improvement	1			1		8	1	2	5	
Integrity	0					7	1		6	
Interprets	4		2	2		3		3		
Inter-professional	0					2	2			
Knowledge	11		7	4		14	2	12		
Leadership	0					11			11	
Limit	0					3		1	2	
Measure	0					1		1		
Method	3		1	2		8	1	6		
NeuroMSK	4		4			3		3		

Table 3 The frequency of key words (or their derivatives) in the 2010 and 2016 CCE-International Accreditation Standards *(Continued)*

	2010 Standards					2016 Standards				
Word	Total number	Headings	Student	CP	Other	Total Number	Headings	Student	CP	Other
Outcome	1	1				22	2			5 footnotes
Patient	7		7			34	3		31	
Participation	2		1	1		5	2		3	
Perform	3		2	1		11	1	7	3	
Policies	7	2		5		22	3		19	
Prevent	0					9	2	7		
Promotion	2			2		9	2	4	3	
Public	4		1	3		8		1	7	
Recognize	3				3	6		5	1	
Research	10	1	4	5		13	2		11	
Resources	7	4		3		13	3	9		1 footnote
Respect	4		1			7		4	3	
Requirements	12			12		15			15	
Relationship	2		2			6	2	3	1	
Safe	2		1	1		6		5		1 footnote
Scholarship	1			1		5	1	4		
Scope of Practice	2		1	1		2		1		
Serve	1		1			4		4		
Skills	6		6			13	4	9		
Staff	11	1		10		5			5	
Stakeholder	0					8			8	
Standard	25	3		22		44	2		42	
Strategies	0					3		2	1	
Student	16			16		43	8		35	
Support	2			2		11		3	8	
Transparent	0					3			3	
Wellness	1		1			2		2		

structures and staff where chiropractic education takes place and moves toward expecting the CP to provide outcome measures that demonstrate the student is acquiring the skills, knowledge, and attitudes to become a competent chiropractor who safely and effectively delivers patient care. This process is intertwined with the expectation that this will lead to continuous quality improvement of the CP.

We found that CCE-International accreditation standards of 2016 have, in general, moved in a positive direction. However, some differences and omissions were not positive. These were not in accord with the evolution of public health frameworks that has seen a move toward engaging a broader range of stakeholders and a move toward the community collective values of transparency, evidence-based effectiveness, and accountability [21].

Discussion of findings

Construction of accreditation standards

The current CCE-International standards were developed using a review process that was limited to its member agencies and 'stakeholder' consultations. The 'stakeholders' were not identified. Concerns have been raised about the lack of transparency for initiatives and changes being adopted by accreditation agencies [22–24]. Consequently to avoid the accusation of political bias or agenda, the qualifications, experience and affiliations of all participants and 'stakeholders' should be carefully selected and clearly stated. In addition, external health science educators outside of chiropractic and health consumer representatives should be involved.

High quality accreditation standards should involve a review of the evidence base for each standard, new material

development, and a field methodology to trial and refine the new standards [11, 22].There was no information on whether this involved a comprehensive review of the evidence base for each standard, nor was a field trial reported to have been conducted. Past research has already raised questions about the absence of an evidence-based approach in CCE accreditation standards and this lack of rigour raises further concerns over their validity [9, 10, 13].

Perhaps reflective of this absence in the educational standards is the recent American Chiropractic Association's re-branding initiative that involved an extensive internal review by a consultant which found that the chiropractic profession is now very insular and has a wide variance in quality and treatment options for patients [25]. The American Chiropractic Association solution was to ask members to increase collaboration with other health care professionals and become more evidence-based. While laudable, it may be simplistic to expect that a profession can change quickly in this regard as such change is likely to be slow to happen and difficult to implement [26]. In order to obtain change, the target group should be as geographically local as possible, value diverse evidence and involve the use of multimethod programs [27]. This suggests that changes are best initiated at the undergraduate level and accreditation processes may be one such lever.

Future iterations of accreditation standards should consider the implementation of a more rigorous analysis of the available evidence and other health professions' accreditation standards, as well as employing 'outside' appropriately qualified experts as mentioned above. Also recommended is the field-testing of new standards in order to make necessary 'adjustments' in positive directions possible within the chiropractic profession.

Accreditation standards require a common understandable and unifying language [28]. Previous studies have shown that follow-up analysis based on monitoring is required to ensure the language employed in any new standards is properly interpreted and that its impact is as intended [12]. Too often improvement has been assumed and not measured [1]. The new accreditation standards are considerably more detailed than the preceding standards. Nevertheless, the 2016 standards appeared to discuss approximately the same number of domains as the 2010 version but each in more detail. By being "wordier" this may address a concern that minimalistic language inhibits the interpretation and uptake of accreditation standards [29]. To this end, a revisit to all the stakeholders, especially CPs, for feedback on interpretation and implementation of the 2016 standards may provide valuable information for the CCE-International for continued improvement.

Overview and foreword

The 2010 standards concept of a chiropractor moved from giving particular attention to the relationship between the structural and neurological aspects of the body in health and disease to become a health profession concerned with the diagnosis, treatment and prevention of mechanical disorders of the musculoskeletal system in the 2016 standards. While there is confusion among chiropractors as to their scope of practice [30] patients do not suffer this quandary [31]. Patients want a practitioner who deals with musculoskeletal issues [32] and not wellness care or any type of primary prevention of musculoskeletal or public health-related disorders [33]. Thus, the more recent concept is likely to be in closer accord with patient expectations and the known evidence for the outcomes of manual therapy for musculoskeletal injuries.

Research suggests that a hybrid accreditation model involving regulatory compliance alongside quality improvement, such as the 2016 CCE-International standards, is continuing to evolve internationally and appears to be effectively promoting minimum standards and results in enhanced safety cultures [20, 34]. Consequently, we recommend accurate monitoring of the hybrid model with the intention of integrating this into future accreditation standards.

While there is some accreditation processes that have promoted the concept of "excellence" in chiropractic education more needs to be done. With few exceptions accreditation has largely focused on a pass-or-fail adequacy evaluation mechanism. Although in some instances a quality improvement standard has been added [35], a true excellence standard has not been introduced. Medical education regulators have taken steps to create an additional level of attainment to evaluate whether medical schools are capable of going above and beyond the traditional scope of accreditation by providing a superior level of education [36–38]. The intent of this is to recognize and promote outstanding performance of medical schools and provide role models for other medical educators. Many medical programs have engaged in this process and sought such recognition [39]. The CCE-International is a suitable vehicle to create a program such as this to incentivize and recognize quality chiropractic education.

Program/educational standards

The wider health community expects that accreditation assessment should incorporate the widespread use of objective educational outcomes measures [3, 40, 41]. The 2016 CCE-International standards, when compared to those of 2010, demonstrate alignment with this expectation. This is clearly stated in the Introduction of the 2016 standards and the increased frequency of related words further entrench this change in assessment of CPs.

There have been concerns over the lack of quality measures available to regulators for assessments of some of the stipulated standards [42]. For example, how is the requirement to create lifelong learners measured? The 2016 standards do not define in detail outcome measures or indicators that should be used for this purpose. CCEs could assist CPs by clearly stating which measures are best utilized to demonstrate achievement of the desired competencies. If none exists, or the quality is poor, then CCEs, CPs, and the profession at large could support research to this end.

Further, the frequency of the term "evidence-based" has been shown to be an indicator of the quality of accreditation standards and their regulation [15, 43]. The words 'evidence-based' neither appear in 2010 nor the 2016 standards. In fact the Glossary of the 2016 standards contains information explaining why the term is deliberately excluded. The nearest term is 'evidence-informed', which occurs once and in relation to student clinic patient care. Concerns have been raised about the failure of the chiropractic profession to embrace evidence-based practice and that the use of 'evidence-informed' is a form of soft resistance to the more widely accepted term evidence-based practice. There is a contention that the "evidence informed" practice places emphasis on practice experience and not on research [44]. In combination this indicates an apparent reluctance to align with accepted mainstream evidence-based health care education standards. A PUBMED search for "Evidence-informed practice" results in 123 articles, whereas "Evidence-based practice" results in 17,737. This speaks for itself as to the acceptance and common use of these terms.

The move toward less prescriptive faculty requirements and the removal of minimal standards for academic and clinical faculty in CPs may be viewed as further evidence of this reluctance. Likewise is the removal of the requirements for students to be able to critically appraise clinical studies, and scientific and clinical knowledge. Despite these limitations staff are expected to facilitate research to contribute to the chiropractic profession. Without prior knowledge on how to critically appraise research projects and research publications, it would be difficult for students and staff uneducated in research methodology, to absorb the full value of such activities.

Medical education views members of faculty as exemplars in the delivery of safe, effective, systems-based approaches to patient care, with the intention and ability of instilling ideas of quality values in the students they teach [45]. Faculty are expected to recommend the use of integrative approaches, inter-professional team-based patient-centred care that uses evidence-based medicine to provide safe and effective treatments for people in pain [46]. It is reasonable to assume that members of chiropractic faculty have an equally important role in the students they teach. However, it is difficult to see how the removal of minimal qualifications for faculty and the lack of evidence-based drivers are supportive of this concept. The reinstatement of these omissions from the 2010 standards is recommended as a starting point.

Procedures for initial accreditation and reaccreditation

Several studies have shown the benefits of accreditation standards that are collaborative and involve an inclusive process [12, 24]. The 2016 standards contain several words indicative of a trend toward a more collaborative approach. For example, the word "stakeholder" is considerably more frequent than before. This is congruent with studies showing that public/stakeholder involvement in the design and implementation enhances accreditation standards [24, 47]. Another way of enhancing the engagement and confidence of stakeholders is to adopt a policy of transparency in the accreditation processes [23, 47, 48].

However, some have suggested that transparency of the entire process reduces open communication between health educational programs and regulatory bodies [49] and is only acted on by a small number of citizens [50, 51]. Others have suggested it increases standards by contributing to consumer empowerment and affecting compliance through concern over public image [52]. Initial glances of CCE websites show varying levels of transparency with the CCE-Europe publishing site evaluation reports and the remaining choosing not to. There is no evidence to suggest that there have been adverse outcomes in chiropractic standards in Europe with the adoption of this standard. A recent systematic review of public health policy and practice found that 'transparency' is now considered a main moral value and a norm [21]. The authors can see no reason why all CCE standards should not reflect this societal norm. Further, the standards should not aim at protecting the schools (from insight) but to protect the public (from substandard education and hence from unsuitable clinicians).

Accreditation is predicated upon the reliability of site visitation teams' judgments but the reliability of this process is unknown and difficult to study [49]. Consistent site team reports are more likely when reliability of the process and consistent application of standards are pursued [49]. A starting point would be to ensure that site team members are appropriately qualified, trained, instructed and provided with instruction manuals. No such requirement is found in the 2016 standards. International standards for medical school inspectors expect the team member to have extensive experience in the profession, with a minimum of experience in high managerial positions (ranging from 2 to 5 years), and profession-specific certification [53]. Some selection

processes for medical inspectors have been known to incorporate lists of clearly defined personal attributes and competence such as communication, perceptiveness and administrative skills [53]. No research could be found identifying any aspect of site visitation of CPs. This would appear to be an area that requires further investigation to ascertain what best facilitates the uptake of accreditation standards and quality improvement among the CPs.

Graduates from for-profit colleges earn less than those from not-for profit colleges in the USA. For-profit colleges also tend to incur higher fees [54] and have higher student attrition rates [55]. Consequently, it is not surprising that concerns have been raised as to whether students can earn enough to justify the investment and pay back their student loans [56]. The omission of the requirement for the CP to be linked to a not-for-profit educational institution is therefore interesting. However, the 2016 standards appear to ensure that potential students have complete and objective information about the costs and expected benefits of a CP. This may also address the concern of aggressive and potentially misleading recruitment practices, poor ethical practices, and inappropriate commercial influences occurring in CPs, which have been documented in other health education programs [54, 57].

What is not in the CCE-international 2010 and 2016 standards

This comparative study has only included data within the standards of CCE-International 2010 and 2016 standards. Relevant material may not be present in either version. One such area is the inclusion into chiropractic curriculums of non-evidence based constructs such as *subluxation* as an 'objective' lesion and *vitalism* as a model of treatment other than as a historical concept [15, 58]. This could be viewed analogously with an accredited Astronomy program that also teaches Astrology throughout its curriculum or an Ophthalmology program that includes Iris Diagnosis. Silence in CCE documents about such 'sentinel' terms could be interpreted as consent even though this may not be the intention.

This is particularly relevant as unorthodox chiropractic practice patterns, such as considering the chiropractic subluxation an encumbrance to the expression of health, anti-vaccination attitudes, and low levels of inter-professional referrals have been related to specific CPs suggesting that they are still actively teaching *vitalism* [8]. There is contemporary evidence that shows this occurs in some chiropractic institutions, even after having passed through a CCE inspection and being granted re-accreditation. For example "LIFE's (Marietta GA campus) educational and clinical philosophy is based on Vitalism. ." [59]. Also, the New Zealand College of Chiropractic states on its web-page "The philosophy of chiropractic is vitalistic in that it acknowledges the body's ability to self-regulate, coordinate and heal. This philosophy guides our curriculum, strategy and culture throughout the College" [60]. To our knowledge, both colleges have been CCE accredited.

A further example is the inappropriate use of the term 'subluxation' in CPs apart from its use as an historical term. A previous study has counted the number of courses mentioning 'subluxation' in North American CPs. It found the Palmer College (Florida campus) devoted 22% of its curriculum to courses mentioning 'subluxation' followed by Life University (Marietta GA campus 16%) and Sherman College (13%) [61].

We recognise that regulation is more than 'rule compliance' and should encompass methods and mechanisms that encourage CPs to go beyond mere compliance [36, 37, 62]. However, at this point in time, some CPs are not actively pursuing the mainstream healthcare norm which is evidence-based practice. Silence in accreditation documentation on such matters hinders the integration of chiropractic into the wider healthcare community. What is required are prescriptive standards that are clearly evidence-based, actively monitored and enforced.

Recommendations

This review has sought to identify similarities and differences between the CCE-International 2016 and 2010 accreditation / educational standards that has led to the identification of a number of issues. Based on these, we make some recommendations that are summarised in Table 4. If these recommendations were adopted, then outcomes, such as a uniform and high standard of accreditation standards based on evidence and shown to be effective before implementation, would be more likely to be similar across all CCE-controlled regions. This could assist in ensuring and safeguarding the international trust in CPs' ability to produce practitioners who can deliver ethical, safe, and quality care across international borders. It would also likely assist chiropractors becoming accepted by other health care professions.

We recognise that there is a substantive cost in engaging experts to assist with accreditation, establishing an awards system, conducting an evidence-based review of accreditation standards, trialling them with quality research and publishing the findings in the peer-reviewed literature. Debate exists in the medical education literature over who should shoulder this financial impost [63]. Such a debate will need to take place for chiropractic education with attention to how such funding can take place without compromising the independence and integrity of the CCE-International.

Table 4 Summary table of recommendations

	Recommendations In relation to Standards	Justifications
1	All participants in the accreditation process and their qualifications for the task are clearly stated. A broad range of participants including health consumers and non-chiropractic educators should be included.	To ensure the construction of accreditation standards are transparent and draw on as wide a range of expertise as possible.
2	A review of the evidence-base of the CCE-International accreditation/ educational standards	This would allow stronger alignment with contemporary medical standards and increase acceptance of chiropractic into the mainstream health care system.
3	A trial methodology of the new standards.	The CCE-International could address potentially problematic areas such as poor comprehension, compliance or uptake.
4	Adoption of industry standards of 'qualifications' for faculty and site investigation team members (as well as appropriate training).	Enhanced CP teaching and research with improved faculty qualifications. Increased quality of site visitation members offers more expertise for quality improvement, and evaluations that are more efficient and effective.
5	Transparency of accreditation processes e.g., publication of (re) accreditation reports and recommendations.	CPs are mindful of public image and marketability and this would reinforce compliance with standards. Increases consumer empowerment.
6	Regular reviews and integration of emerging research to continually update accreditation standards. Especially with respect to quantifying required CP outcome measures.	More efficient and accurate assessments of CPs.
7	The adoption of an evidence-based approach to all aspects of the teaching and practice of musculoskeletal healthcare.	This is the expectation of society, patients and health care education in general.
8	Create an award system as part of chiropractic accreditation for excellence in education.	To incentivize chiropractic programs to create high quality education and desirable models for other CPs to emulate.

Methodological considerations

This was a comprehensive comparison that included all the material from the 2010 and 2016 CCE-International Accreditation Standards. The screening method matched all the 2010 areas and subareas to the 2016 standards. The authors remain confident that they have found the areas, subareas and terms and that they appropriately classified them for accurate comparisons. The search for other key terms, however, could perhaps have resulted in other findings and conclusions.

There was a high degree of agreement between the two readers / authors on text interpretation and allocation. Hence, there was not a need to draw on the third author for any interpretations that could not readily be resolved by discussion.

Thematic identification can result in data being interpreted several ways and it is difficult to know if the themes identified are relevant [16]. We have made the judgements for theme identification clear and there was good agreement across coders. Nevertheless, we may not have identified every relevant word. However, we are confident in the findings, as the authors have published in the area, have worked with CCEs and, consequently, are familiar with similar documentation. Finally, the adjectival word list was large and this also reduces the likelihood of omitting many important words.

It should also be borne in mind that the frequency of terms does not necessarily relate to the quality of the document and we recognize that program evaluation extends beyond these documents alone and requires an extensive self-evaluation, inspection and review process. However, the contents of these standards are clearly the foundation for such evaluations, and are therefore important documents to scrutinize.

Conclusions

This comparison of the old and the revised CCE-International accreditation standards revealed that the new standards are more detailed when describing the competencies required for the graduating chiropractor and the re-accreditation process for CPs. On the positive side, it also shows that progress is being made aligning with current research and accepted standards. Interestingly, these standards are now based on a definition of the chiropractic profession dealing with musculoskeletal problems and apparently not opening the door to the treatment of other diseases via the spine.

However, there is still considerable progress to be made with respect to the rigour of the application of an evidence-based approach to accreditation standard development and trialling the standards before implementation. The term 'evidence-based' is still lacking. We hope that this is not an attempt to amalgamate the two large factions within the profession, i.e. those inclined towards vitalism and those who are more interested in treating musculoskeletal problems. Full transparency of the expertise, qualifications and affiliations of all participants and stakeholders would allay such concerns.

We noted the removal of minimal qualifications for faculty, that it is no longer necessary for the CP to belong to a not-for-profit educational institution, and we

noted also the absence of specified qualifications for site visitation teams.

An opportunity exists to further improve the CCE-International standards with the addition of standards specifically addressing known non-evidence based curricula as well as producing desired models of education with the creation of an awards scheme for recognition of excellence.

Abbreviations

CCE: Council on Chiropractic Education; CCE-International: Council on Chiropractic Education – International; CP: Chiropractic Program

Authors' contributions

SI, BW and CLY were responsible for the study design. SI and CLY undertook the data analysis and interpretation. SI developed the initial and iterative draft. BW and CLY were responsible for reviewing and redrafting the final manuscript. All contributed to the final version. All authors read and approved the final manuscript.

Ethics approval and consent to participate

This study was an analysis of freely available website content and did not involve collecting sensitive data from human participants; hence, ethics approval was not required.

Competing interests

Bruce Walker (BFW) is Editor-in-Chief and Charlotte Leboeuf-Yde (CLY) is Senior Editorial Adviser of the journal *Chiropractic & Manual Therapies*. Neither played any part in the assignment of this manuscript to Associate Editors or peer reviewers and are separated and blinded from the editorial system from submission inception to decision.

Publisher's Note

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Study: Chiropractic students' perceptions of education: Psychometric evaluation of questionnaire.

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Chiropractic students' perceptions of education: Psychometric evaluation of questionnaire.

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Abstract

Background:

Measures to assist chiropractic programs evaluate their educational programs for accreditation and quality improvement purposes are currently unavailable.

Aim:

The aim of this study is to produce a valid and reliable questionnaire that captures the students' perceptions of their professional education, using chiropractic students as an example.

Method:

In order to make this questionnaire relevant for accreditation purposes the potential questionnaire items were selected from the Australian chiropractic accreditation standards that related to student experiences. Chiropractic students rated these items for clarity and relevance, which resulted in a pilot questionnaire of 47 items. The same cohort also completed this pilot questionnaire twice for validation purposes. Principal components analysis was used to establish the structure of the scales. Cronbach's alpha was then derived to determine whether all items in each scale tapped a discrete construct. Finally intra-class correlation coefficients were used to establish the scales' test-retest reliability.

Results:

Thirty-four items were omitted resulting in the retention of 13 items that strongly loaded onto 5 factors. Internal consistency was found to be adequate. The test-retest reliability ranged from adequate to good for four of the derived factors. The test-retest reliability of the fifth was poor and omitted.

Conclusion:

A valid questionnaire has been developed comprising four scales that enquire about chiropractic students' perceptions of: 1) quality of the educational program; 2) provision of student support services; 3) enablement of independent learning; and 4) adequacy of teaching resources.

Key Words: Education, Chiropractic, Outcome, Validation, Accreditation.

Introduction.

Education programs that train health professionals are required to meet standards set by regulatory bodies. The intent is to protect the public and provide safe and effective health care by ensuring competent training [1]. There has been increasing interest in education environments and their role in professional health care training [2]. Recent research has identified the need for measures of the educational environment for medical accreditation processes [3-6]. This lack of measures has also been raised as an issue for chiropractic accreditation [7-11].

It is proposed that the educational environment consists of two main aspects: tangible and intangible factors [12]. Tangible factors encompass objective components, such as the physical infra-structure of classrooms, training facilities, and equipment [12, 13]. Intangible factors are subjective and include subtle features such as the "personality" traits of an institution [12]. These intangible factors can be difficult to objectively measure [14]. However, they are manifested in students' everyday experiences and perceptions, which provide an avenue for measurement [15]. Consequently, students are increasingly being recognised as a key source of information for assessing the educational environment particularly for re-accreditation purposes [16]. However, at present there is no gold standard for assessing medical students' perceptions of the educational environment [6].

Such a gold standard would ideally possess evidence for validity of content, response process, internal structure and relationship to other variables [6]. Further it would be a 'nimble' questionnaire that is efficient to administer and complete, widely applicable and sensitive to change over time [6].

The most common method for developing items in such questionnaires is to use sources thought to be related to the student experience. For example, one of the most widely used, the Dundee Ready Education Environment Measure (DREEM) [17], was developed based on the Dundee University Medical School records of the curriculum planning committee meetings. The intent was to develop items that would measure the targets of 'Health for All

by the Year 2000' i.e., a person's ability to work productively and participate actively in the social life in the community in which they live [18]. However recent research has questioned the DREEMs psychometric properties [2, 19]. Another questionnaire, the Postgraduate Hospital Environment Measure, employed Postgraduate Deans and Educational Supervisors to develop and agree on a list of possible items based on a literature review [20]. Concerns also exist for the psychometric properties of this measure [21]. Hence, none of these two commonly used assessment tools used as their source of inspiration formal accreditation documentation. By deriving items from such documentation the questionnaire would potentially be 'purpose built'.

Presently there has been a shift in the approach by accrediting agencies to move toward a model of competency or outcomes-based education [22, 23]. No longer do accreditation standards prescribe detailed specified curriculum content. Rather, each institution is expected to provide the means by which students can achieve the desired competencies as well as systems for their assessment. Therefore, it would seem logical to consider students' perceptions as a part of the evidence for re-accreditation purposes.

It is evident that there is a need to develop a psychometrically robust and 'nimble' tool for the evaluation of health education programs for accreditation purposes. Such a questionnaire should provide information to provide feedback for educational providers to improve their educational programmes. Therefore, the aim of this study is to produce a valid and reliable questionnaire that captures the students' perceptions of their professional education relevant to accreditation of the program, using chiropractic students as an example.

Methods.

Human Research Ethics Committee approval was granted by Murdoch University (Project No 2017/ 112).

Development of the Preliminary Questionnaire

The initial questionnaire items were derived from the accrediting agency for chiropractic programs in Australia accreditation standards, namely the Council on Chiropractic

Education-Australasia (CCE-A) 2009 and 2017 Accreditation and Competency Standards [1, 24]. Both standards were used because the study occurred during a transition period between the 2009 and 2017 standards.

The educational standards were downloaded and any criteria that related to students were extracted and copied verbatim. This created an initial item set that was refined by splitting double-barrelled statements into separate statements (See Appendix 1). Some items were then reworded to enhance their clarity or transform statements into questions. For example, the criterion "It is required that programs have a balance between formative and summative assessment", was rephrased as "Do you agree that the chiropractic program (CP) has assessment that is balanced between formative and summative assessment?" Finally, items were deleted if they were considered largely irrelevant to students' evaluation of the quality of chiropractic programs. E.g., Do you agree that the chiropractic program has an admission policy that is consistently applied?

The initial list consisted of 67 potential items (Appendix 1). After splitting double-barrelled statements into separate statements, it consisted of 73 items. Removal of irrelevant items refined this initial item set to 62 questions distributed across the following six domains: Chiropractic Program; Student Experience; Student Assessment and Learning; Staff; Resources; and the Teaching Clinic. Expert panels on two occasions used a Content Validity Index (CVI) to assess the content validity of the refined initial item set [25, 26]. The composition of these panels accorded with guideline recommendations, which state that CVI panels should comprise six to twelve participants with backgrounds representative of the target population [25, 26]. We therefore recruited chiropractic students.

All fifth-year chiropractic students were asked if they would like to join the panels by chiropractic staff who did not have any classroom involvement with them. On the first occasion, the expert panel consisted of 11 chiropractic students who responded to this invitation. Each panel member assessed each item using four categories: not relevant; needs major revision; needs minor revision; and very relevant. Consistent with guideline recommendations, a value of '*one*' was awarded to either the "needs minor revision" or "very relevant" categories, and '*zero*' was awarded to either the "not relevant" or "needs major revision" categories [25, 26]. An Item-Content Validity Index (I-CVI) was calculated for

each item by summing the values for each rater and then dividing by the number of raters. An item was retained if its I-CVI was greater than 0.79 [25, 26]. Of the 62 questionnaire items reviewed, 17 recorded an I-CVI below 0.79 and were subsequently deleted.

The student panel also made written recommendations to improve the phrasing of the some of the 48 items that were retained from the initial item set. A smaller focus group comprising five chiropractic students who were involved in the study as part of their undergraduate study was then held to incorporate the feedback to improve the wording of the remaining items.

Next, an expert panel was convened to evaluate the content of the rephrased 48 items with a CVI, using the same method and criteria as described above. This panel consisted of seven chiropractic students who volunteered to further assist from the original 11-student-panel along with four chiropractic academics. On this occasion, all but one of the items recorded an I-CVI value above 0.79, resulting in a final pilot questionnaire comprising 47 items (Appendix 1).

Diagram 1. Flowchart of method used to derive survey items.

The final pilot questionnaire was distributed to all fourth and fifth year chiropractic student at Murdoch University on two occasions at a three week interval [27, 28]. The rating of each item ranged from 'strongly disagree' (assigned a score of 1), 'disagree' (a score of 2), 'Neither agree nor disagree' (a score of 3), 'Agree' (a score of 4) and finally 'Strongly agree' (a score of 5). The questionnaire was administered twice in order to examine its test-retest reliability.

Data Analysis

In order to establish the structure of the scales in the questionnaire we performed a principal components analysis with a varimax rotation. It was determined a priori that the principal components analysis would be undertaken from data obtained from the administration of the questionnaire on the first occasion. An item was retained if the loading on a component was .45 or higher [29]; the item did not have a cross-loading of .32 on another component [30]; and the item conceptually fitted with other items on the component [31].

For the validity testing, Cronbach's alpha was used to examine the internal consistency of the scales that were derived from the retained items to determine whether all items within a scale tapped the same construct. A two-way mixed effects, absolute agreement Intra-class correlation coefficients (ICC) model was used to establish the scales' test-retest reliability. Finally, floor and ceiling effects were explored by calculating the proportion of respondents who achieved minimum or maximum total scale scores. Floor or ceiling effects are considered to be present in a sample size of at least 50 people if more than 15% of respondents achieved the lowest or highest possible score, respectively [28]. All data were entered and analysed in SPSS v.24.

Results.

For the flow of the study, number of participants and final questionnaire construction, see Figure. 1. In total, on the first administration the pilot questionnaire was completed by 78 students out of 111 (response rate of 70%) and 60 students (54%) on the second administration. In all, 56 students completed the questionnaire at both time points.

Questionnaire's Structure

Of the 47 items in the pilot questionnaire, 34 items were omitted because of either low factor loadings or cross-loadings between factors. This resulted in the retention of 13 items, which strongly loaded onto five factors (Tables 1 and 2) that accounted for 70% of the total variance. These factors were conceptualised as: Factor 1: Program Quality; Factor 2: Student Support; Factor 3: Developing Independence; Factor 4: Learning Resources; and Factor 5: Teaching Clinic Staff Support of Students.

Test-retest Reliability

Table 3 displays the ICC values for all scales. Moderate levels of reliability were observed for scales F1 (Program Quality), F2 (Student Support), F3 (Developing Independence), and good reliability was obtained for the F4 (Learning Resources) scale [32-34]. Poor reliability was observed for the F5 (Teaching Clinic Staff) scale, which was consequently deleted, leaving a questionnaire comprising 11 items distributed across four scales. Examining the ICC for the remaining four scales combined together yielded a value of 0.95 (95% CI= 0.93-0.96), which indicated excellent reliability for the overall scale.

Internal Consistency

The Cronbach alpha values for each of the four retained scales ranged from 0.62 to 0.83, which indicates that all four scales had adequate levels of internal consistency [35, 36] (See Table 3). The overall scale Cronbach alpha was 0.95.

Descriptives for the Final Questionnaire

Table 4 displays the frequencies for all items in the retained four scales. Means and standard deviations for the four retained scales and overall total scale score are presented in Table 5. The proportion of respondents who achieved either the minimum or maximum score did not exceed 15% for any of the retained four scales, which meant that no ceiling or floor effects were observed [37, 38].

Discussion.

This is the first study we are aware of that has sought to develop a questionnaire to assess the chiropractic student study experience by using the regulators' own accreditation standards; a questionnaire that could be used by Australian chiropractic programs (CPs) to monitor students' perceptions of their course for accreditation and quality improvement purposes. The final questionnaire demonstrated adequate internal consistency and test-retest reliability.

Our report details the development of a questionnaire that was designed to assess Australian chiropractic educational programs from a student's perspective. It comprises 11 items in four scales that enquire about: 1) quality of the educational program; 2) provision of student support services; 3) enablement of independent learning; and 4) adequacy of teaching resources. In addition, psychometric testing showed that these four scales can be combined to provide an overall summary measure of the students' opinions of the chiropractic program.

The item reduction techniques employed in this study accord with best practice recommendations for the development of outcome measures [28]. Our interrogation of the questionnaire's structure yielded a parsimonious item set that clearly delineated four discrete constructs. However, deletion of redundant items resulted in an item set that did not assess areas of chiropractic programs such as the appropriateness of student assessments, quality of staff and teaching clinic environment. Many of the redundant items were deleted because of item cross-loading between factors, which indicates a lack of conceptual clarity for the formulation of the redundant items. It may be worthwhile to re-examine the content of the scales to identify item sets that more clearly assess the constructs that encompass student assessments, staff quality and the teaching clinic, given that it might be important to understand students' perceptions of these program areas.

There are also CCEs for Canada [39], Europe [40] and the America [41]. The CCEs of Australia, Canada and Europe are member agencies of the CCE-International [42]. As such these agencies purport to be collaboratively working toward equivalent standards. This suggests that the questionnaire designed in this study has the potential to provide valuable information for chiropractic programs in Europe and Canada. However, before the

instrument is used in these settings, its cross-cultural reliability and validity should be established in further validation studies to explore its general applicability. Similar studies could be done in other health care professional areas, using this as an example.

Limitations.

Demographic details were not collected, which meant that we could not establish the representativeness of our study's participants. Future studies should include such information for this purpose. Also, the sample for this study was recruited from a single Australian university. It is therefore unclear if this study's findings can be generalised to other chiropractic programs in Australia and other CCEI members in Europe and Canada. Further psychometric testing of the instrument developed in this study is therefore warranted in other chiropractic program settings. In addition to consolidating the instrument's validity and reliability, further psychometric evaluation should incorporate an assessment of the instrument's construct validity and responsiveness.

Directions for Further Research

The construct validity of our questionnaire should be established by concomitantly administering it with a validated generic measure of students' perspectives about the quality of university education. Such an analysis could be enhanced through incorporating measures of other constructs that have been influenced by students' educational experience. A recent systematic review of the DREEM has suggested these constructs may include quality of life, resilience, preparedness for practice, peer support, and psychological distress [2].

Finally, assessing our questionnaire's responsiveness could be challenging. To establish whether our questionnaire is responsive, ideally, it would be necessary to administer the questionnaire in the same student cohort before and after they have been exposed to changes in educational program content. It is unlikely that such an assessment can be practicably undertaken.

Conclusion

The questionnaire presented in this study is the first tool that has been specifically developed to evaluate a health education program using accreditation standards from a student's perspective. It can potentially provide educational stakeholders with information about the chiropractic program's educational content and student support services, the adequacy of learning resources, and its facilitation of independent learning skills. Such material could importantly inform the direction of quality improvement programs that enhance the learning experience of chiropractic students. Nevertheless, further testing in other settings would be necessary to be certain that the results can be translated to other disciplines, other courses and in other countries.

List of Abbreviations Used

CCE-A: Council on Chiropractic Education of Australasia

CCE-I: Council on Chiropractic Education International

CP: Chiropractic Program

DREEM: Dundee Ready Education Environment Measure

ICC: Intra-class correlation coefficients

I-CVI: Item- Content Validity Index

Declarations Section.

None.

Ethics Approval and Consent to Participate

Ethics approval was granted from Murdoch University Human Research and Ethics Committee (Project No 2017/112).

Consent for publication

Not applicable

Availability of data and materials

Yes, subject to obtaining additional Ethics approval

Competing interests

None.

Funding

Not applicable.

Authors' contributions

SI, and CLY were responsible for the study design. SI and NS undertook the data analysis and interpretation. SI and NS developed the initial and iterative draft. NS, BW and CLY were responsible for reviewing and redrafting the final manuscript. All contributed to the final version. All authors read and approved the final manuscript.

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Tables from the Results Section

Table 1. Total Variance Explained by the Five Extracted Factors

	Initial Eigenvalues		
Component	Total	% of Variance	Cumulative %
1	3.17	24.37	24.37
2	1.79	13.78	38.15
3	1.67	12.84	50.99
4	1.23	9.46	60.45
5	1.19	9.12	69.56

Table 2. Five Factor Structure of the 13 Extracted Items.

Rotated Component Matrix [a] Component	1	2	3	4	5
Factor 1: Program Quality					
P2 The CP promotes high quality teaching	0.72				
P4 The CP seeks to minimize risks to the students while learning	0.54				
P5 The CP seeks to continually improve the program	0.66				
P6 The CP content is based on evidence-based practice	0.79				
Factor 2: Student Support					
S1 Students have ways to deal with concerns or complaints		0.63			
S3 The CP provides emotional well-being support services for students		0.88			
S4 Student support services are provided by qualified personnel		0.79			
Factor 3: Developing Independence					
S11 The CP ensures students are prepared to be responsible for learning processes				0.86	
S12 The CP ensures students are prepared to become lifelong learners				0.84	
Factor 4: Learning Resources					
R2 The CP provides adequate access to on-line resources			0.91		
R3 The CP lecture rooms are satisfactory			0.91		
Factor 5: Teaching Clinic Staff					
TC4 The teaching clinic staff are easy to gain access to					0.85
TC 5 The teaching clinic staff support the students					0.81
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a] a. Rotation converged in 6 iterations. CP Chiropractic Program					

Table 3. Internal Consistency and Test-Retest Reliability

Factor	Scale	Cronbach Alpha	Intra-class correlation coefficient (95% CI)
1	Program quality	0.62	0.56 (0.26 – 0.74)
2	Student Support	0.71	0.69 (0.47 – 0.82)
3	Developing Independence	0.73	0.64 (0.38 – 0.79)
4	Learning Resources	0.83	0.79 (0.63 – 0.87)
5	Teaching clinic staff	0.64	0.41 (0.00 – 0.65)
Total Score	Overall	0.95	0.95 (0.93 – 0.96)

Table 4. Item Frequencies of Items Retained in Final Questionnaire

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Factor 1:Program Quality					
The CP promotes high quality teaching	1.3	1.3	14.5	65.8	17.1
The CP seeks to minimize risks to the students while learning	0.0	2.6	9.2	57.9	30.3
The CP seeks to continually improve the program	2.6	5.3	21.1	47.4	23.7
The CP content is based on evidence-based practice	0.0	0.0	5.3	42.1	52.6
Factor 2: Student Support					
Students have ways to deal with concerns or complaints	6.6	2.6	23.7	50	17.1
The CP provides emotional well-being support services for students	1.3	10.5	32.9	42.1	13.2
Student support services are provided by qualified personnel	0.0	4.0	28.0	48.0	20.0
Factor 3: Developing Independence					
The CP ensures students are prepared to be responsible for learning processes	1.3	1.3	9.2	56.6	31.6
The CP ensures students are prepared to become lifelong learners	0.0	3.9	10.5	55.3	30.3
Factor 4: Learning Resources					
The CP provides adequate access to on-line resources	0.0	6.5	10.4	66.2	16.9
The CP lecture rooms are satisfactory	0.0	11.7	14.3	53.2	20.8

CP; Chiropractic program

Table 5. Descriptive Statistics for Final Scales

	N	Minimum	Maximum	Mean	Std. Deviation
Factor 1: Program Quality	56	9.00	20.00	16.63	2.06
Factor 2: Student Support	55	7.00	15.00	11.15	1.99
Factor 3: Developing Independence	55	4.00	10.00	8.30	1.26
Factor 4: Learning Resources	56	4.00	10.00	7.86	1.54
Valid N (listwise)	54				

Appendix 1. Original Items Derived from the CCEA Accreditation Standards with Weighted Scores

Do you agree that Murdoch University CP in general	Weighted Score
PROGRAM (P)	
#P1. The CP has progression requirements and processes that are fair (and transparent).	.86
P2. The CP has mechanisms to ensure quality and integrity of the programme of study.	.91
P3. The CP promotes high quality teaching (and learning, scholarship).	.89
P4. The CP promotes research.	.98
P5. The CP seeks to minimize risks to the students while they learn	.86
P6. The CP seeks to continually improve the program.	.93
P7. The CP uses valid and reliable evaluations to improve the program.	.72
#P8. The CP content is based on evidence-based practice (& contemporary research)	1
P9. The CP can change in response to contemporary developments in health professional education	.89
# P10. The CP has a coherent educational philosophy that informs the program of study (design & delivery).	.91
P11. It is easy to find good information about any aspect of the CP	.70
#P12. The CP is of sufficient scope to make a competent chiropractor (and quality)	.86
P13. The CP offers a program that is relevant	.89
P14. The CP is capable of producing good chiropractors	.86
P15. I am clear about the learning objectives of the course.	.93
~~*** Has quality improvement processes that use valid and reliable student and other evaluations, to improve the program.*~~	
~~***Includes representatives of the chiropractic profession for the design and management of the program.*~~	
~~***Has mechanisms for responding in the curriculum to contemporary developments in health professional education in an effective manner.*~~	
STUDENT (S)	
S1. Students have ways to be able to deal with concerns or complaints.	0.82
S2. The CP provides support to meet the learning needs of students.	0.89
S3. The CP provides emotional support services for students	0.89
S4. Students' support services are provided by qualified personnel.	0.95
S5. Students are involved in the decision making processes of the CP.	0.82
#S6. Student feel that the CP promotes equity (and diversity principles).	0.89
S7. The CP has the confidence of new graduates.	0.95
S8. Protection of the public and patients is important in the CP.	0.93
S9. The CP is an enjoyable place to be to learn about chiropractic	0.91
S10. Students achieve the relevant competencies before providing patient care.	0.95
#S11. Students are held to high levels of (ethical and) **professional conduct.**	1.00
S12. The CP ensures that students have the responsibility for their learning processes	1.00
S13. The CP ensures that students are prepared to become lifelong learners	0.95
~~***Student impairment screening and management processes are effective.*~~	
~~*** Students have access to effective grievance and appeals processes.*~~	
~~***Students are informed of and have access to personal support services provided by qualified personnel.*~~	
~~***Students are represented within the deliberative and decision making processes for the program.*~~	
~~***Equity and diversity principles are observed and promoted in the student experience.*~~	

Do you agree that Murdoch University CP in general	Weighted Score
ASSESS / LEARNING (A/L)	
AL1. The CP uses different types of assessment Eg., both formative and summative	0.93
#AL2. The CP has (consistent and) **appropriate assessment to students.**	0.91
#AL3. The CP has (consistent and) **appropriate feedback to students**.	0.75
AL6. Student assessment covers important learning outcomes and competencies.	0.98
AL7. The CP has learning outcomes that address the chiropractic competency standards.	0.93
AL8. The CP teaches how to work with other health professionals	0.85
AL10. The CP teaches about cultural awareness	0.95
AL11. The CP develops your research skills.	0.93
AL12. The CP exams are fair	0.91
~~***The CP uses multiple validated assessment tools and modes including direct observation in the clinical setting.***~~	
~~***** Student assessment is related to the relevant chiropractic competency standards.***~~	
~~***** The CP has teaching and learning environments that ensure the achievement of the required learning outcomes.***~~	
~~***** The CP exams are meaningful***~~	
~~***** Has the scope of student assessment covers all learning outcomes and competencies.***~~	
STAFF (St)	
#St1. The teaching staff clearly communicate the course material	1
#St2. It is easy to gain access to the teaching staff	1
St3. Teaching staff support the students.	.89
St4. Teaching staff conduct themselves professionally.	.93
** *The lecturers are competent*	.98
RESOURCES (R)	
#R2. The CP facilities and equipment are accessible, (well maintained, and fit for purpose).	.82
R3. The CP provides adequate access to on-line resources.	.80
R4. The CP lecture rooms are satisfactory	.93
R5. The CP equipment is satisfactory	.84
**The CP has the resources to facilitate the achievement of the standards necessary to be a competent chiropractor.	
CLINIC (C)	
C1. Student clinic has quality and safety practices.	0.98
C2. The student clinic has the necessary resources and equipment	0.87
C4. The clinic staff clearly communicate the course material	0.91
C6. The clinic has a mix of patients that will adequately prepare students for becoming a chiropractor.	0.89
C7. The clinical staff are easy to gain access to.	0.80
C8. The clinic staff support the students.	1.00
C9. The clinicians are conduct themselves professionally.	0.95
~~***** Student clinics meet relevant jurisdictional requirements and standards.***~~	
~~****Students are registered with the relevant regulatory authorities.***~~	
~~****Students are registered with the relevant regulatory authorities.***~~	
~~****** Students are registered with the relevant regulatory authorities.***~~	

Double barrel item that was split. ** Removed.

CHAPTER 4: CCE site inspection.

Attribution

Chapter Four of this thesis is published as the following study

- Innes SI, Leboeuf-Yde C, Walker BF. Investigating CCE Site Inspection Standards and Processes: The Why From When Things Went Awry. (In Press Chiropractic and Manual Therapies).

Stanley Innes co-designed the methods and analyses with the co-authors. In addition, Stanley Innes drafted the original manuscript, and then submitted it. All authors critically reviewed and approved the final version.

Summary and link to next chapter

Objective Three sought to determine if CCEs use the same standards and processes for inspection teams when inspecting chiropractic educational institutions for adherence to the specified accreditation standards and graduate competencies. While Objective Four was attempting to determine if a sample of chiropractic educational institutions consider that they fulfil these standards according to their self-evaluation reports and where possible compare and contrast this with CCE final inspection reports and accreditation standards. By comparing CCE final site report findings with CP self-evaluations common areas of concern for regulatory site visits could be identified. This may also reveal past successful strategies for quality improvements of chiropractic teaching programs used to address these issues.

CCEs were approached by email to participate in this research project. CCEs were asked to provide the previous 5 years of CP site inspection reports, and after redaction to their satisfaction to ensure confidentiality. Ethics approval was obtained. CCEs were resistant to this scrutiny. Three of the four CCEs were not prepared to participate. While disappointing, it was nonetheless revealing of the attitude of the accrediting agencies and required a re-thinking of the original thesis plan in order to explore this aspect of accreditation. A qualitative approach which offered personal contact with a smaller number of participants was considered. In particular, previous CCE staff or executive members who had extensive experience with academic standards and processes.

The next chapter in this thesis was designed to gain an understanding of how other stakeholders thought and functioned within the CCE accreditation framework. To this end an exemplar case study using chiropractic students was undertaken.

Study: A Failed Review of Council on Chiropractic Site Inspection Standards and Processes

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Abstract

Background

Accreditation of educational programs involves an independent agency assessing quality against a set of defined standards. Site inspection teams are appointed by an accrediting agency and compile a report with the intention of identifying deficiencies and making recommendations for their rectification and continued improvement. For chiropractic programs accreditation is carried out by Councils on Chiropractic Education (CCEs). However, the reliability of their site inspection teams remains unknown. Recent research has suggested that variability in chiropractic practice may be partially traced back to the education provider. This raises the possibility of deficient accreditation procedures that may include unsatisfactory site inspection standards or processes or the accreditation standards by which they work to.

We sought to compare the various CCEs documented standards and processes for site inspection teams for similarities and differences with the intent of making recommendations to create uniform and high quality standards. Further, we sought to compare a sample of CCEs site inspection team surveys / reports for commonly identified recommendations and quality improvements and determine if they are adequately described in their accreditation standards.

Method

In December of 2018 invitation emails were sent to 4 CCEs through their website portals outlining a proposed study investigating site inspection teams' standards and processes. Access was requested to all appropriately redacted documentation relating to site inspection teams and their chiropractic program reports. Follow up emails were sent several weeks later.

Results

Only one of four of the CCEs responded by providing the requested information.

Conclusion and Recommendations

Three CCEs did not cooperate with this educational research. The possible reasons for the non-engagement is discussed.

Key Words: Chiropractic, Accreditation, Evaluation, Educational research

Background

The number of chiropractic education programs has increased considerably over the past decades. Some are run as private initiatives, some are included in university structures, sometimes even within a medical school setting. Concomitantly, perhaps both as a result and a driver, evidence-based practice approaches have become important and the traditional chiropractic *vitalistic* approaches downgraded, at least 'officially'.

Accreditation standards and inspection procedures have been established worldwide by Councils on Chiropractic Education (CCEs) to safeguard standards and to ensure harmonisation between schools and geographical regions. CCEs are variously mandated and exist for the purposes of assuring educational quality and institutional integrity to governments, regulatory bodies, chiropractic programs, professional organizations, students and the public at large. Members of the CCEs may be elected or appointed.
Medical education has adopted science and evidence-based practice as a basis for training [1]. This is not always the case for chiropractic education. Some CCE accredited chiropractic programs have aligned with an evidence-based mainstream healthcare approach and declared that since there is no evidence for vitalist or subluxation beliefs it has no place in chiropractic training, except from as a historical context [2]. Other CCE accredited colleges have continued to hold to a *vitalist* philosophy. Some even openly

advertise vitalistic statements such as the New Zealand College of Chiropractic *"To offer well-resourced, integrated, relevant, evidence based curriculum with the correction of vertebral subluxation as the primary chiropractic aim"[3]* and *" The purpose of chiropractic is to help people reach and maintain excellent health and wellbeing through the care of the spine and nerve system [4].*

This has implications for patient safety and quality of care. Vitalist or subluxation trained chiropractors have been characterised by excessive X-ray usage, anti-vaccination beliefs, and poor levels of inter-professional / disciplinary communication [5, 6].

This raises the two questions,

i. How can these vitalistic educational practices occur?
ii. Why are these issues not discovered and dealt with during the CCE inspections?

In our opinion, this suggests two possibilities; chiropractic accreditation standards are not addressing such issues adequately or there is inadequate monitoring and site inspection processes. Site inspection teams, appointed by the accrediting agency, is the mechanism by which program performance is assessed against prescribed standards. Such teams compile a report with the intention of identifying deficiencies and making recommendations for their rectification and continued improvement.

We have previously conducted a systematic review of these accreditation standards, and made a series of recommendations with the intention of improving their uniformity and quality [7]. The intent of this study was to conduct a similar systematic review of the site inspection standards and processes to the same end.

Medical education is frequently 'overseen' by accreditation agencies, whether governmental or private. This activity rests on (among other things) the relevance of inspection, the skills and knowledge of the

inspection teams, and the subsequent use made of any recommendations for improvement [8]. Obviously, accreditation and re-accreditation surveys depend on the expertise of the people involved and are therefore at risk of becoming subjective and even invalid. Historically the reliability of inspection team surveys has been unknown and difficult to study [9]. Nonetheless it is recognised as an important area for further attention as it is under-investigated [10-12].

Research to date has identified several factors that are thought to increase the likelihood of improved outcomes of this process. These include having the processes for inspection surveys clearly outlined, standardized and consistently applied to the accreditation standards [9], strong communication skills within an experienced team and team members should be temporary or replaceable so that it promotes allegiance to the accrediting organisation [11]. Also the teams should undergo detailed training and mentoring [13]. Yet another paper suggested that team members should have extensive experience in the profession, with a minimum of experience in high managerial positions (ranging from 2 to 5 years), and profession-specific certification [8].

Intrinsic to the accreditation process of chiropractic, as performed by the various CCEs, is the site inspection team appointment, training, co-ordination, quality control and review, and implementation of the survey team's final report. However, we could not find any previous work on the monitoring aspect of the tasks of the CCEs, nor with respect to site visitations for accreditation or re-accreditation purposes of chiropractic programs in PubMed, Scopus or ChiroIndex databases.

Clearly, regardless of how good the accreditation standards are, unless the monitoring process is relevant, consistent and effective, they will not be reinforced in teaching institutions that, prefer to deviate in other directions.

In view of these problems, we wanted to see if there is an appropriate and comprehensive approach to inspecting chiropractic programs for re-accreditation by site inspection / surveys by CCEs.

Aim

The aim of this systematic audit was to investigate similarities and differences between the various CCEs inspection site team documentation and processes and compare these to known quality standards and the available evidence.

Objectives

The objectives were to:

1. Review and compare the available site team inspection documentation from each CCE to look for similarities and differences.
2. Review and compare a sample of CCEs site inspection team surveys / reports for commonly identified recommendations and quality improvements and determine if they are described in their respective accreditation standards.
3. Make recommendations that would create a high-quality set of site inspection team standards and processes that is consistent with known best standards and evidence.

Methods and Analysis

Ethics approval was obtained from Murdoch University Human Research and Ethics Committee (2018/238) for this study.

We intended to conduct a systematic audit to investigate the three objectives.

Eligibility criteria

The World Health Organization recommends the CCE-International as the source of information regarding evaluation of chiropractic education [14].

Consequently, we included all those CCEs who were members in good standing. The CCE-USA was a member in good standing of the CCE-I since inception until 2015 and is home to the largest number of chiropractic programs [7]. Also, the CCE-USA Accreditation Standards were released in 2013 and remain current [15]. Consequently, the CCE-USA was included in the analysis.

Thus four CCEs were included in total; Council on Chiropractic Education Australasia (CCE-Australasia) [16], Council on Chiropractic Education Canada (CCE-Canada) [17], the Council on Chiropractic Education (CCE-USA)[15], and the European Council on Chiropractic Education (ECCE) [18]. A fifth CCE was identified, the Council on Chiropractic (International) CCE-I which is a federation of the other four CCEs. The CCE-I does not conduct site inspections and was not included.

Invitations

An email invitation with the study information was sent to the four CCEs (CCE-A, CCE-C, CCE-USA, ECCE) via their website portal in mid-December 2018 (Additional File 1). A follow up email was sent to the non-responders in mid-January of 2019.

Data extraction process and synthesis of results

Objective 1. A Systematic Audit of CCE Site Inspection Team Documentation and Processes

Method: All CCEs were approached and asked for copies of their documentation related to site inspection of chiropractic programs. CCEs were asked to de-identify all data using redaction. Once obtained these data would be further scrutinized to ensure no identifying information was found. The data would then be recorded and tabulated for a comparative analysis. This method had been used in three previous systematic reviews investigating CCEs accreditation standards [19-21]. For these studies the documentation used in the analysis was obtained because it was accessible

to the public from CCE websites. The table format to compare for similarities and differences was to be structured to identify similarities and differences with respect to the following elements;

i. Team composition
ii. Team selection criteria for chiropractors and consumer members
iii. Team training / instruction
iv. Report construction

The findings were to be compared to inspection team survey documentation from another widely known and recognised Medical Accreditation organisation, such as the Australian Medical Council [22] or the Accreditation Council for Graduate Medical Education [23].

This was to allow for the identification of similarities and differences in CCEs site inspection standards and processes.

Objective 2. A Thematic Analysis of CCEs Site Inspection Team Final Reports;

Method: We sought to obtain copies of CCEs Site Inspection team final reports of chiropractic programs for the last 5 years from CCE-Australasia, CCE-Canada, CCE-USA and the ECCE. The reports were to be coded to identify themes and de-identified to ensure confidentiality.

Two researchers would independently review the reports and place each recommendation made by the site inspection team under the appropriate Accreditation Standard.

The two researchers would then compare their decisions for report recommendation placement and then discuss any differences. A third reviewer was available to resolve any instances when a recommendation could not be placed.

The process allows an understanding of whether the inspection team reports are comprehensive and consistent when compared to the

accreditation standards. Identified 'gaps' could inform future iterations of accreditation standards as well as CCEs training of site inspection teams.

Objective 3. Recommendations for creation of a high-quality set of site inspection team standards and processes.

By conducting this comparative process, and considering the evidence, similarities and differences between CCEs and other quality non-chiropractic inspection standards and processes could be identified enabling the proposing of recommendations to create uniform and high quality international set of site inspection standards, report construction and processes.

Results

Responses were received from 3 of the 4 CCE organisations.

The CCE-USA referred us to their website and declined to forward any further material. Information on their website related to site inspection standards and processes but did not include training or recruitment data. This CCE also declined to provide site inspection team reports, as they deemed these reports to be disclosed at the discretion of the chiropractic program (CP) only. It was also claimed that this was to protect the confidentiality of CCE members, CCE office staff and CPs, and to comply with the overarching bodies' policy of not making accreditation activities open to the public for release.

The CCE-Canada did not respond to our request despite further correspondence.

The CCE-Australasia informed us that this material was confidential in nature and could not be reproduced or commented on in any public domain or format. Also, this CCE took the view that site inspection reports were confidential and released only at the discretion of the CP. Further that this related to the integrity of the accreditation process as it depends,

in part, on the Council and the Committee maintaining confidentiality with all aspects of the process other than the reporting of procedure and decisions. We recontacted this CCE and asked them to reconsider their decision on the grounds that their overarching government organisation had a policy on research and this area of investigation was identified as a high priority. Also that this study would meet all the confidentiality and privacy requirements and was redacted and not being released to the public but to researchers. The CCE-Australasia responded "*The CCE has considered your response and we re-confirm our original position as advised previously*".

The ECCE readily complied and forwarded all site inspection documentation, including their training information. This also included site inspection team reports that were, in fact, also available on their website.

This resulted in a complete and usable set of desired documents from only 1 of the 4 CCEs.

Discussion

Summary of Findings

We contacted four CCEs with a letter explaining a study to investigate CCEs site inspection team standards, processes, and documentation as well as seeking copies of reports from chiropractic program inspections. This letter presented the reasons and rationale for the study, appropriate ethics approval, and addressed the sensitive area of confidentiality and anonymity. Only 1 of 4 CCEs responded positively and agreed to participate.

Potential explanations

The unwillingness to participate is puzzling as the 4 CCEs are undertaking the same task, with the same goals, using supposedly uniform standards.

So, while one of the CCEs was completely transparent the other three were not at all. Clearly, this makes it difficult for the CCEs to compare and align activities between themselves. This compares poorly with a similar study of Dental programs in Australia in 2007, where such inspection team reports were readily made available using the same research methodology [24].

We considered several possible explanations for the non-participation of the CCEs. First, is that these organizations do not differentiate between the public and researchers. When we made this differentiation on a repeat request one of the non-participating CCE did not change its mind. Obviously the CCE had control over ensuring that confidentiality requirements were met as they were invited to remove any sensitive information before forwarding the required documentation. Perhaps there was a distrust of the authors by the CCE or an overcautiousness that resulted in a decision to be wary despite the authors having University Ethics approval.

It is tempting to speculate that these responses of 'silence' and 'public confidentiality' were stimulated by a lack of confidence in their own standards and processes for site inspection of the various chiropractic programs. This may have resulted in an approach to camouflage this possibility by refusing to participate. Alternatively, these organizations may be confident in their established standards and methods and have no desire to change them.

It is argued by some that transparency of accreditation findings motivates educational or healthcare programs to hide any short-comings and avoid 'brand damage' that would result in a reduced capacity to compete in a competitive market place [25]. This could be less important in regions where there is a greater number of student enrolments than available places in CPs.

Proponents of confidentiality hold to the view that an environment without negative public consequences improves the likelihood of

disclosure by CPs to CCEs [26, 27]. The resultant openness between agency and educator produced by this 'safe environment' is thought to be conducive to a collaborative working relationship that increases the chances of quality improvements [28]. However, the evidence for this is elusive.

The question for us as bona fide educational researchers, is why did one of the four CCEs trust the authors and agree to fully participate while the other 3 did not? We suspect that cultural differences may be one factor as the positively responding CCE already transparently publishes inspection team reports on their website. It is also possible that there are differences between the composition of the CCEs executives that influence the willingness to subject themselves to scrutiny with the possibility of having to change and improve. Those who argue in favour of such transparency believe the public and students have a right in a democratic society to know of educational practice standards [29]. They also argue that the possibility of positive reports motivates educational programs to strive to improve themselves and increase their marketability [26, 28].

Conclusion

We could not compare the CCE site inspection standards and processes because only one provided information. We conclude that there is a wide discrepancy in transparency between CCEs on the topic of site inspections.

Future research to develop a clearer understanding of the internal machinations and thinking of CCEs with respect to such matters may be best obtained through interviews with key personnel.

List of Abbreviations Used

CCE: Council on Chiropractic Education

CCEs: Councils on Chiropractic Education

CCE-International: Council on Chiropractic Education – International

CP: Chiropractic Program

ECCE: European Council on Chiropractic Education

Declarations Section

None.

Ethics Approval and Consent to Participate

Ethics approval was granted from Murdoch University Human Research and Ethics Committee (Project No 2018/238).

Consent for publication

Not applicable

Availability of data and materials

Not applicable

Competing interests

Bruce Walker (BFW) is Editor-in-Chief and Charlotte Leboeuf-Yde (CLY) is Senior Editorial Adviser of the journal *Chiropractic & Manual Therapies*. Neither played any part in the assignment of this manuscript to Associate Editors or peer reviewers and are separated and blinded from the editorial system from submission inception to decision.

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Authors' contributions

SI, BW and CLY were responsible for the study design. SI and CLY undertook the data analysis and interpretation. SI developed the initial and iterative draft. BW and CLY were responsible for reviewing and redrafting the final

manuscript. All contributed to the final version. All authors read and approved the final manuscript.

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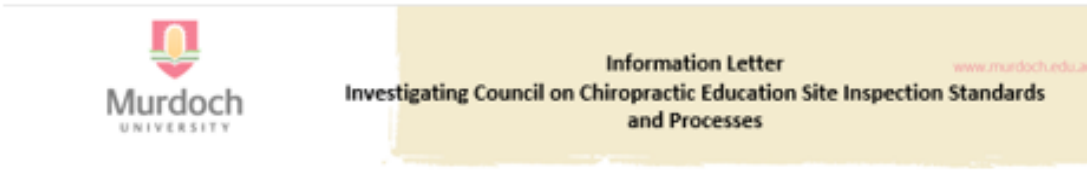
Additional File 1.

Title: Study Invitation.



Information Letter
Investigating Council on Chiropractic Education Site Inspection Standards and Processes

Dear CCE

We invite you to participate in a research study looking the standards and processes CCEs use for site investigation of chiropractic programs. This study is part of my PhD, supervised by Professor Bruce Walker and Professor Charlotte Leboeuf-Yde at Murdoch University.

Nature and Purpose of the Study
Our studies to date have reviewed the various CCE accreditation and competency standards. To continue this line of study we seek to obtain, for comparative purposes, the documented material from each CCEs with respect to how they select, train, and monitor these site inspection teams. In addition we would like to review the resultant reports for the past 5 years.

If your organisation consents to take part in this research study, it is important that you understand the purpose of the study and the documentation you will be asked to provide. Please make sure that you ask any questions you may have, and that all your questions have been answered to your satisfaction before you agree to participate.

What the Study will Involve
If you decide to participate in this study, you will be asked to provide the following documents. **Please note that these documents should be redacted by you to exclude the name of any individuals and also selected information that would identify the institution being inspected.**

In particular we would like to access material such as inspection site team selection criteria, team structure e.g. team leader selection criteria and responsibilities of each member, team training, directions for report writing, expectations of team members, team performance review, and accessibility to the final report to the public / other institutions / or agencies.

It is also our intent to review the inspection team reports for the past 5 years and compare the recommendations made by the various CCEs to chiropractic programs. This study has Human Research Ethics Committee approval (2018/238) from Murdoch University and we will take every measure possible to ensure the chiropractic programs confidentiality and anonymity.

Please note that it is our intention to disseminate the results of this project and this should be of interest to your important authority. Also that in the interests of transparency it is our intention to publish this correspondence and your response to this correspondence (if any) in our ultimate article to explain our ability or otherwise to complete this project.

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Voluntary Participation and Withdrawal from the Study

Your organization's participation in this study is entirely voluntary. You may withdraw at any time without discrimination or prejudice. All information is treated as confidential and no names or other details that might identify your organization or the chiropractic programs the site team reports relate to, will be used in any publication arising from the research. If you withdraw, all information you have provided will be destroyed.

Privacy

Your privacy and confidentiality is very important to us. We will make every effort to ensure anonymity in all documentation we receive. This entails you redacting all personal and potential identifying information. It will thus not be possible to identify any chiropractic program in any publication arising out of this study.

Benefits of the Study

It is possible that there may be no direct benefit to your organization from participation in this study. However, the information may provide CCEs with better strategies to conduct the site inspection team aspect of their accreditation and re-accreditation processes. To this end we will provide a de-identified summary of the overall research outcomes to the four organisations (CCEs) for dissemination within their organization. Information from this study may be presented at conferences and in published articles.

Possible Risks

There are no specific risks anticipated with participation in this study.

If you have any questions about this project please feel free to contact either myself Stanley Innes at Murdoch University on ph.(08) 9360 2841. I will be happy to discuss with you any questions you may have about this study. Alternatively my supervisor is Professor Bruce Walker, on ph. (+61 8) 9360 1297.

Once we have analysed the information from this study we will put on our web site a summary of our findings. You can expect to receive this feedback in 9 months. http://www.murdoch.edu.au/School-of-Health-Professions/Our-Research/Chiropractic-Research/. By forwarding the appropriate documentation you are indicating your consent to participate in this study. Please forward this to the lead investigator Stanley Innes (S.Innes@Murdoch.edu.au).

Thank you for your assistance with this research project.

Sincerely

Stanley Innes

This study has been approved by the Murdoch University Human Research Ethics Committee (Approval 2018/238). If you have any reservation or complaint about the ethical conduct of this research, and wish to talk with an independent person, you may contact Murdoch University's Research Ethics Office (Tel. (+61 8) 9360 6677) or e-mail ethics@murdoch.edu.au). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

CHAPTER 5: The relationship between chiropractic students' personality, beliefs and attitudes with clinical decisions.

Attribution

Chapter Five of this thesis is published as the following three articles:

- Innes SI, Leboeuf-Yde C, Walker BF. The relationship between intolerance of uncertainty in chiropractic students and their treatment intervention choices Chiropractic & Manual Therapies, 2017, 25:20. doi.org/10.1186/s12998-017-0150-2
  Accessed 1,757 times, Citations 4. Altmetric Attention 4. As at date 12/8/2019
- Innes, S., Leboeuf-Yde C., & Walker B.F., Chiropractic student choices in relation to indications, non-indications and contra-indications of continued care. Chiropractic & Manual Therapies, 2018, 26:3.
  Ac*cessed 1751 times, Citations 2. Altmetric Attention 8. As at date 12/8/2019*
- Innes, S., Leboeuf-Yde C., & Walker B.F., How frequent are non-evidence-based health care beliefs in chiropractic students and do they vary across the pre-professional educational years. Chiropractic & Manual Therapies, 2018, 26:8.
  Accessed 2,734 times, Citations 1. Altmetric Attention 26. As date 12/8/2019

Stanley Innes co-designed the methods and analyses with the co-authors, analysed the data and contributed to their interpretation, drafted the manuscript, and submitted the manuscript. All authors critically reviewed and approved the final version.

Summary and link to next chapter

Objective 5 aimed to explore the relationship of unsuitable chiropractic practice profiles and clinical decision making with various intrinsic and extrinsic factors in students and practicing chiropractors and the consequent implications for CCE accreditation standards and graduate competencies. This chapter focused on an exemplar case study using chiropractic students from two Australian CPs before investigating practicing chiropractors.

Important and novel questions were asked to gain an understanding of the way those students who function within, or as a result of, these accreditation standards think, interact and function in healthcare education. The studies were aimed at exploring the frequencies of non-EB beliefs, the role of personality, level of self-belief and their clinical decisions.

Surprisingly chiropractic students, despite being enrolled in CPs that were signatories to an EBP approach, had frequent non-EB beliefs that appeared to be resistant to the educative process in all years of the program. Students over-rated the likely therapeutic benefit of spinal manipulation resulting in the belief there were few circumstances in which spinal manipulation would not benefit a person with spinal pain as well as a range of non-musculoskeletal conditions. Finally, it was discovered that personality may play a significant role in the clinical decisions chiropractic students make. This has direct implications for patient safety and quality of care and warranted confirmation and further exploration. It should also be of direct interest to CPs and CCEs.

Informed by these findings methodological changes were made expanding the personality measure and non-EB beliefs and a study was devised to further investigate these relationships in practicing chiropractors using a practitioner-based research network (ACORN) whilst retaining the same clinical scenarios. This constituted Chapter Six.

Study: The relationship between intolerance of uncertainty in chiropractic students and their treatment intervention choices.

Innes et al. Chiropractic & Manual Therapies (2017) 25:20
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Chiropractic & Manual Therapies

RESEARCH Open Access

The relationship between intolerance of uncertainty in chiropractic students and their treatment intervention choices

Stanley I Innes[1*], Charlotte Leboeuf-Yde[1,2,3,4] and Bruce F Walker[1]

Abstract

Background: Psychological factors, such as intolerance of uncertainty (IU), have been shown to impact on the quality of medical care. However, this psychological measure has not been studied in the chiropractic profession. Our objective was to investigate if higher levels of IU in chiropractic students were related to poor choices of management in specific clinical scenarios. Also, we sought to investigate if levels of IU were related to students' intentions to adopt a prescriptive chiropractic technique system and evaluate their levels of self-belief.

Method: Between October and November of 2016, students from two Australian chiropractic programs ($N = 444$) answered a questionnaire on measures of IU levels, patient case scenarios for neck and low back pain, and questions about self-ratings of their future chiropractic abilities and perceived need for the adoption of a chiropractic technique system. Associations were tested by the IU score and the therapeutic choices relating to a) a neck pain case scenario, b) a low back pain scenario, c) various technique systems, and d) the self-rated competence level treating the IU score both as a continuous and a categorical variable.

Results: There was an overall response rate of 53%. Those students who were high in levels of IU were significantly more likely to make incorrect clinical decisions than those with normal or low levels of IU for the neck pain case scenario. No differences were found on the low back pain scenario, on preferences to use a technique system in the future, or on predicted self-rating of competence after graduation.

Conclusions: Psychological factors, such as IU, may have an impact on chiropractic students' clinical decisions. However, it does not impact on all aspects of practice. This finding has implications for chiropractic educators, especially when dealing with neck pain. However, it may be relevant to continue the search for specific personality profiles in relation to various favourable and unfavourable practice patterns, as it is unknown whether these dynamics are important for other aspects of chiropractic education.

Keywords: Intolerance of uncertainty, Practice patterns, Chiropractic, Education

Background

Professions accepted into the mainstream health care system are expected to provide high quality care. In chiropractic, the educational institutions have a responsibility to select and educate students to this end. Failure in this task may have undesirable consequences for chiropractors, patients, and public health.

External circumstances, such as educational facilities, curriculum, and staff are not solely responsible for graduate attributes. Intrinsic factors within students will also influence educational outcomes and ultimately practice standards. Clearly, psychological profiles play an important role in determining human behaviour, both positively and negatively. In this context, intolerance of uncertainty (IU) could be one such psychological factor. IU refers to a dispositional characteristic that reflects a set of negative beliefs about uncertainty and its implications and represents an underlying fear of the unknown [1, 2]. IU has also been described as an incapacity to endure the aversive response triggered by the absence of salient, key or sufficient information [3]. These negative beliefs about uncertainty in everyday

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situations are inflexible and result in a desire for predictability [4, 5]. Consequently, IU has been found to be associated with behavioural performance [6]. With such an influence on behaviours, it is not surprising that past research has shown this factor to impact on the decision-making of primary care medical / general practitioners [7].

Specifically, higher anxiety shown as high levels of IU is associated with lower compliance with evidence-based guidelines, manifesting in higher frequency of ordering diagnostic tests, more variability in treatment options for an individual [8], and generally increased resource use in the health care system by medical / general practitioners [7]. It has been estimated that physicians' mean medical management costs increased by 17% for each standard deviation that uncertainty scores increased [7]. In the chiropractic profession, the use of maintenance care in patients who do not improve with treatment could be seen as an example of increased use of resources. This example has been demonstrated in three previous surveys of chiropractors' choice of treatment strategies in patients with low back pain [9–11].

IU has been shown to be associated with lower levels of confidence with decision making, a reduced likelihood to change any previously made decisions despite receiving new information, an increased likelihood to seek additional information (e.g. clinical tests) when not required, and a propensity to react and behave overly cautiously even in low levels of perceived threat [2, 12]. However, the art of clinical practice involves learning to deal with varying levels of uncertainty.

IU is also strongly related to anxiety and this can influence thoughts about one self [13, 14]. Anxious people are more likely to have negative internal working models of themselves [15, 16]. This manifests in the belief that they may not have the resources to cope with uncertain events and are thus more likely to defer to an external source for answers [17]. However, past research has also found that high levels of confidence may result in lower levels of accuracy in clinical diagnosis in medical students and physicians [18]. This would also suggest that IU may be important in clinical decision making.

In contrast, those who have low levels of IU have been shown to be more psychologically flexible, less distressed by uncertainty, and enjoy higher levels of psychological health [2, 19]. Further they are more likely to act in a timely and measured manner [20].

There is a rich history of research exploring the relationship between IU and the behaviour of health care practitioners. However, nothing is known about how IU impacts on chiropractors' self-esteem and clinical practice. For example, would chiropractors who are intolerant of uncertainty be more comfortable with prescriptive technique systems that indicate 'where the problem is' and 'how to treat it', rather than accepting the grey shades of clinical reality?

In chiropractic technique systems, stereotyped answers to 'where the problem is' could allow a purely technical approach such as a Derifield Test for leg-length inequality to identify a biomechanical problem in the pelvis [21], an x-ray analysis for a 'subluxated' vertebra [22], sacro-occipital pelvic blocking based on body sway categorisation [23], and an 'Applied Kinesiology therapy localisation' for area of problem [24]. Examples of 'how to treat' in chiropractic technique systems could be a recipe-based approach, such as the Gonstead x-ray analysis, as it provides information on the side of adjustment and line of drive [25], or an Applied Kinesiology 'challenge' for direction of thrust [24].

The alternative to a purely technical approach is a flexible and open one based on a multitude of findings assimilated without the need for pre-set rules. The first approach is formulaic and tends to reduce the role of the chiropractor to becoming 'technician-like', while the second approach fits in with the societal and regulatory expectations of a licenced qualified health care professional [26].

Studies have identified various profiles of chiropractic practice, some of which were labelled unsuitable [27, 28]. These practice styles are typified by traditional chiropractic 'philosophical' beliefs, technique styles that make recommendations partially or wholly incompatible with evidence-based care, and excessive X-ray usage [28]. A research question in this context is: "Do higher levels of IU play a role in chiropractors choosing to adopt out-dated treatment systems?" This question is important, as such a profile, in turn, may result in unsuitable practice behaviour.

In people with high anxiety scores, it has been established that emotion-laden choices with low probabilities are overweighted and high probabilities are underweighted [29–31]. Thus, when presented with a low threat clinical scenario with multiple options, anxious medical / general practitioners (such as those with higher IU) tend to prematurely seek unnecessary clinical tests or inappropriately refer to another practitioner [7]. In chiropractic, this could perhaps result in a dichotomy of both an overly careful attitude and an unsuitable careless approach. In the first case, chiropractors belonging to this category are likely to refer their patients for inadequately founded reasons or seek second opinions in slightly complicated cases. Alternatively, when presented with a high threat clinical scenario, practitioners with high levels of IU are likely to display the tendency to downplay the risk and not order the appropriate clinical tests or fail to refer for more appropriate care.

Previous studies using specific case scenarios have shown that chiropractors in various countries do not all appear to choose logical treatment strategies for their

patients [9–11]. This may be related to intrinsic factors, such as a higher IU.

The intention of this study was to investigate if higher IU was related to poor choices of chiropractic management in specific clinical scenarios. Specifically, our objectives were to answer the following questions:

1. Is there a difference between IU groups (high versus normal or low levels) in their approach to:

a. a neck pain scenario?
b. a low back pain scenario?

2. Is there a difference between these IU groups in their attitudes to the use of recipe-like technique systems?
3. Is there a difference between IU groups' self-rating of their own skills?

Methods

Study procedure

A team consisting of the three authors designed the questionnaire and four 4th year students from Murdoch University assisted with the survey administration and data collection.

This cross-sectional study was conducted between October and November in 2016. The chiropractic programs based at two Australian universities (Murdoch University and Macquarie University) were used for data collection. This was a quantitative descriptive study using an anonymous classroom handout questionnaire, as this approach facilitated the collection of a large amount of robust data in a timely and cost-effective manner. The entire student population across both programs was invited to participate and consent was obtained prior to completion of the survey.

Ethics approval was granted by Murdoch University (Project No 2016/118) and was classed as negligible risk research.

The project followed the same protocols in both institutions, consent was obtained from students, data were non-identifiable (anonymous) and permission was obtained from the Head of the Macquarie University chiropractic program to conduct the research. Accordingly, the study met the criteria for classification under the National Statement on Ethical Conduct of Human Research (2007) (Sections 5.1.8 and 5.1.22) as exempt from requiring ethics approval from both Universities.

The questionnaire

The survey contained four sections (see Additional file 1), with the results of some sections to be reported elsewhere. The first section sought demographic details (chiropractic program, sex, year of study) as studies on medical students indicate that levels of IU decrease over the course of training [32]. Further, age and sex have been shown to be independent predictors of IU [33].

In the second section, we devised direct questions to determine attitudes towards chiropractic care and clinical behaviour. The survey also sought students' attitudes toward their likelihood of giving advice in their own chiropractic clinics and their beliefs on the capacity of spinal manipulation to impact on a number of health issues. It also asked students about their beliefs on the need, once graduated, to adopt a rigid comprehensive chiropractic technique system, which would inform them of the patient's presenting problem (i.e. a technique system used to reduce uncertainty).

The third section was comprised of two clinical scenarios from previously published case management scenarios with chiropractors [9, 34]. A full description of the rationale for each clinical scenario and the rationale for classification of correct and incorrect choices is attached (see Additional file 2).

In the first case study, five scenarios were presented, beginning with a simple uncomplicated case of neck pain, which gradually progressed through to a scenario requiring immediate medical referral. The neck case consisted of the following general information: "A 28-year old man, tennis player by profession, consults you for a right-sided intense neck pain without any radiating pain. You note an antalgic position of the head, no other musculoskeletal signs (eg., no acute torticollis), no other health problems in particular, normal x-rays for his age, and no signs of alert (red flags)." [34] There was a choice of six answers for each of the five scenarios ranging from treating the patient on his/her own through to not providing treatment and arranging referral.

In a previous study, consensus was demonstrated on the most appropriate management choices across the five scenarios, thus allowing differentiation between chiropractors who select appropriate and inappropriate intervention strategies [34]. The inappropriate choices related to referral out of the chiropractic clinic when the patient should have been treated by the chiropractor and also to continued care when the patient should have been referred out.

The second case described a range of clinical scenarios for a patient with low back pain designed to identify which management strategies the chiropractors preferred to use in response to various outcomes of the initial treatment program [9]. This questionnaire had nine possible outcome scenarios that were briefly described. Six clinical management alternatives were offered for each outcome scenario. The basic facts for this hypothetical patient were: "A 40-year old man consults you for low back pain with no additional spinal or musculoskeletal problems, and

with no other health problems. His X-rays are normal for his age. There are no 'red flags'".

The nine additional scenarios were constructed in such a way as to include cases that went from uncomplicated to more difficult, including scenarios with no past history of low back pain, those with intermittent low back pain over the past year, and those with several similar events over the past year. In three previous studies, a pattern of self-reported clinical management strategies was demonstrated which allowed identification of those clinicians who did and did not follow 'clinically logical' answers (see Additional file 2) [9–11].

The fourth section consisted of the Intolerance of Uncertainty Scale. We chose the validated 12-question version (IUS-12) that utilises a 5-point Likert scale with responses ranging from 'not at all characteristic of me' to 'entirely characteristic of me' [1, 35–38]. Examples of questions included 'unforeseen events upset me greatly' and 'the smallest doubt can stop me from acting'. The maximum possible score was 60, reflecting high levels of intolerance of uncertainty.

Lastly, we asked students to rate themselves as a chiropractor compared with other chiropractic students in their class.

Procedure

The content and wording of the questionnaire were pilot-tested by a small number of chiropractors. The questionnaire was adjusted in response to their comments and tested on a small number of chiropractic students. This process detected some logical errors in the description of the attitudes and beliefs and resulted in some wording changes, which further improved the content, wording and design of the questionnaire.

Students in both chiropractic programs were informed that participation was voluntary and would be anonymous. Students in years 1 and 2 were not given the case scenarios in their survey, as they were deemed to have inadequate clinical knowledge.

Variables of interest and analysis of data

Data were entered and analysed in SPSS v.22 (IBM Corp, Armonk NY, USA) after identifying and correcting any incomplete or corrupt data. All survey items were dummy variable coded and descriptive statistics generated.

Predictor variable

Visual examination of the distribution of the IU scores suggested a cut-off score at scores of 36 and above for construction of the two IU groups. Receiver operator characteristic (ROC) curves were utilised to evaluate potential high IUS-12 from total IUS-12 score. Sensitivity and specificity of the coordinate points of the resulting ROC curve were used to identify the potential cut-off score for IUS-12. The optimum critical value for the IUS-12 was identified as 35.5. Subsequently scores of 36 and above were allocated into the High-IU group (25% of the students) and those below this score were allocated into a Normal-to-low IU group (75% of the students). This decision was also supported by previous published research with non-clinical samples which used similar values [39, 40].

Outcome variables

Variable 1: Neck Pain Case From the previously published neck pain case [34], the research team determined which answers were the correct and incorrect treatment choices for each of these five scenarios. These are further explained in Additional file 2.

Students were given one point for selecting the incorrect treatment choice for the first two and last two scenarios, making it possible to obtain a score of between zero and four. For items 1 and 2, all the answers other than treating the patient on his own (response A) were considered incorrect. For items 4 and 5, all the answers other than choosing not to treat the patient but instead, referring the patient out (response E), were considered incorrect.

Variable 2: Low Back Pain Case A previously published low back pain case was used, on the basis of which students were asked to identify their clinical decisions [9]. The research team determined which answers were correct and incorrect for i) inappropriate selection of premature referral (items 1,2,4; scores ranging from 0 to 3) and ii) inappropriate selection of continuation of care when referral was indicated (items 6,7,8,9; scores ranging from 0 to 4). Thus, high scores were indicative of an inappropriate management choice. These questions and their rationale for the 'correct' and 'incorrect' answers are described in Additional file 2.

Variable 3: Use of chiropractic technique analysis / evaluation systems The answers to the question on chiropractic technique were dichotomised into yes ('yes' and 'yes probably') and no ('don't know,' 'no, probably not,' 'no').

Variable 4: Belief in Self The rating of students' own future capacity as a chiropractor was grouped into four categories: Below Average ('below average' and 'a bit below average'), Average, Above Average ('A bit above average' and 'above average'), and Don't Know. Preliminary analysis revealed the Below Average groups to be very small, and accordingly, we combined these respondents with the Don't Know group, as we considered both types to indicate uncertainty.

Initially, the mean IU was compared for the chiropractic programs, sex, and year of program to see if subgroup

analyses would be necessary. For this, tests for significant differences and relationships were carried out with Chi-square, ANOVA and linear regression analyses depending on the type of variable and data distribution.

The associations between the IUS-12 score and the scores for the neck pain and low back pain scenarios were tested in two ways. The score was treated as a continuous variable in a linear regression analysis, as this would make most use of the data. In addition the IUS-12 score was dichotomized into high and normal-to-low IU groups and tabulated with the numbers of correct and incorrect scores on the neck and low back case scenarios, as this would allow for a clinical interpretation of the results. We expected that the two types of analyses would go in the same direction.

Thereafter, associations between Normal-to-low and High IU and the predictor variables were tested for significance using the Chi-square test. Estimates were reported with 95% confidence intervals (CI). Preliminary analyses revealed no links between these variables. For this reason and because of small numbers, no sub analyses by institution, sex, or year of program were carried out in relation to tests of association.

To determine if there was a difference between IU groups in the students' approaches to the neck pain case and also to the low back pain case (on both the aspect of maintenance care and inappropriate referrals), responses were dichotomised using the threshold that zero incorrect answers were treated as 'acceptable' answers and one or more incorrect replies were treated as 'unacceptable'.

Results

Descriptive data

Of a possible 313 Murdoch University chiropractic students, 216 (69%) completed the survey and of a possible 518 Macquarie University chiropractic students, 228 (44%) completed the survey, giving a total of 444 students, of whom 224 were male (50%). This sample of 444 from a sampling frame of 831 possible participants gave an overall response rate of 53%. As can be seen in Table 1, there was no difference in IUS-12 scores between institutions or between sexes, whether tested by year of program or for the whole institutional sample. Consequently, the two programs were combined for all subsequent analyses. The mean IUS-12 score (maximum possible score = 60) for the Normal-to-low IUS-12 group was 26.5 (SD = 5.6) and for the High IUS-12 group was 40.2 (SD = 4.2).

All variables of interest have been described in Table 2. As can be seen, approximately 70% were classified as having a 'normal' IU, using our arbitrary cut point. The most common answers for each outcome variable are described below. Almost 80% would have made at least one inappropriate referral for the neck case scenario, whereas about 80% would not have made an inappropriate referral in the low back pain scenario and almost 70% would not have inappropriately recommended maintenance care. Similarly, approximately 80% were positively inclined towards the use of a technique system of analysis. Just over 50% self-rated their predicted clinical competence as above average and only 3% as below average.

Was there a difference between IU groups in the students' approaches to a neck pain case and a low back pain case?

High IU groups were significantly more likely than Normal-to-low IU groups to make incorrect clinical decisions about the neck pain case. No significant differences were found comparing High and Normal-to-low IU groups' numbers of inappropriate choices of maintenance care in the low back pain case. No significant differences were found comparing High and Normal-to-low IU groups' number of inappropriate referrals in the low back pain case (Table 3).

These results were confirmed with the linear regression analysis that was used to test if IUS-12 scores significantly predicted participants' scores on the neck and low back pain case scenarios and their future self-rating as chiropractors. The results of the regression indicated that IUS-12 significantly predicted the response of the scores on the neck pain scenario ($F(1200) = 12.46$, $p = .001$, $R^2 = 0.05$). However, IUS-12 scores were not found to be a significant predictor for scores on the low back pain case scenario ($F(1188) = 1.85$, $p = 0.18$. $R^2 = .004$) or for future self-rating scores ($F(1430) = 0.55$, $p = 0.46$, $R^2 = .001$).

Was there a difference between IU groups in their attitudes to use of 'recipe-like' technique systems?

No significant difference was found comparing High versus Normal-to-low IU groups' preferences for wanting to use a technique system of analysis.

Was there a difference between IU groups in their attitudes on self-rating of own skills?

No significant difference was found comparing High versus Normal-to-low IU groups' preference or self-rating of their predicted clinical competence after graduation. When the highest and lowest self-esteem groups were compared, the percentage estimates indicated that those high in IU were more likely to rate themselves as 'below average' or as 'don't know' (highest self-esteem group = 33%, lowest self-esteem group = 23%) and less likely to rate themselves as 'above average' (67% and 77% respectively). However these findings were non-significant ($p = 0.6$).

Table 1 School, sex, year of program, and students' mean Intolerance of Uncertainty score in a study of Australian chiropractic students

Year of Program	Males/Females	% of respondents' year	IU score Males (0 to 60)(SD)	IU score Females (0 to 60)(SD)
1st year MQ	43/34	[c]	34.2 (8.0)	31.7 (7.7)
MU	31/45	62%	30.9 (6.7)	30.5 (7.7)
2nd year MQ	17/10	[c]	33.9 (8.2)	26.8 (9.6)
MU	17/33	46%	34.1 (6.2)	32.6 (8.5)
3rd year MQ	42/20	[c]	31.1 (7.8)	31.2 (8.5)
MU	19/22	62%	28.3 (10.1)	27.6 (8.3)
4th year MQ	34/25	[c]	28.4 (8.5)	27.6 (8.1)
MU	6/21	79%	27.8 (9.7)	26.1 (6.4)
5th year MQ	3/0	[c]	29.3 (8.6)	
MU	12/10	55%	28.0 (9.7)	22.3 (3.6)
All Years MQ	139/89	69%	31.7 (8.3)	29.2 (8.1)
MU	85/131	44%	30.2 (8.2)	29.9 (8.3)

[c]denotes information not available because students were enrolled across differing years. IUS-12 Cronbach's alpha was 0.87 (skewness 0.20 (SD 0.11), Kurtosis −0.59 (SD 0.23)0

Discussion

Summary of findings

To the best of our knowledge, this is the first study to investigate personality traits in chiropractic students and the impact on their clinical decision-making. The neck pain scenario was clearly a challenge to the students, whereas they appeared more knowledgeable on the low back pain scenario, judging by the fewer numbers of inappropriate choices. The vast majority were positive towards the use of a prescriptive technique system but, interestingly, almost no one rated themselves as below average in predicted clinical confidence.

A High IU predicted an unacceptable approach to the neck pain scenario, either by referring out too early or not referring out where necessary. None of the other outcome variables were significantly associated with the IU.

Discussion of findings and comparison with other studies

This chiropractic student population had IU scores that were similar to previous Australian university studies involving medical and psychology students [41, 42]. Also, their IU scores were sex-invariant as has been previously shown in other cohorts [37]. The only outcome variable to be sensitive to the IU was the neck pain case. High IU was indeed associated with unsuitable choices. Perhaps this can be explained by the nature and structure of the cases. The neck pain case clearly being more alarming than the low back pain case could have made it more anxiety-provoking, particularly in students who do not cope well with uncertainty. The potential for serious consequences from cervical spine manipulation, such as stroke from a cervical artery dissection, is a likely contributor to creating increased anxiety levels, when considering manipulative treatment of the neck.

The reason for the 'non-finding' of the low back pain vignette and IU was unclear. Clearly there is the potential for adverse outcomes, although uncommon, with chiropractic care also for lower back pain. The difficulty and complexity of identifying the pain generator in low back pain is well documented [43] but perhaps students are not aware of this, thus feeling much more at ease with low back pain than with neck pain. Therefore, anxiety could be perhaps be more manifest in practicing chiropractors with high levels of IU and this warrants further investigation.

More recent research has suggested that measures of IU should be designed around the specific situations in which they occur [1, 2, 44]. For example the items in the IUS-12 could be altered in future studies to make them specific to the diagnosis and treatment of lower back pain to improve our capacity to understand the role of IU in low back pain care.

On the finding that the desire to acquire a stereotypical technique system was not associated with high IU, a number of reasons for this result are possible. One hypothesis is that students do not realise that such techniques are based on largely 'belief-based' rules and also do not understand that the body's so-called innate response to human dis-ease and disease cannot be simplified in such a manner, as is often purported in these technique systems.

It is common that people over-rate their own abilities [45], as the students obviously did with only 3% thinking they were below average. In other areas, personality traits have not been found to be highly correlated with

Table 2 Variables of interest in a study of Australian chiropractic students

Variables of interest		All N (%)
IU	Normal	307 (69)
	High	126 (28)
	Missing	11 (3)
[a]Neck Pain Scenario: Number of inappropriate referrals		
0		44 (21)
1		93 (44)
2		48 (23)
3		17 (8)
4		9 (4)
Missing		2(1)
[a]Low back Pain Scenario: Number of inappropriate choices of maintenance		
0		139 (68)
1		43 (21)
2		12 (6)
3		3 (1)
4		5 (2)
Missing		3 (1)
[a]Low Back Pain Scenario: Number of inappropriate referrals		
0		177 (83)
1		22 (10)
2		3 (1)
3		2 (1)
Missing		9 (4)
Preference for Technique System of Analysis		
Yes		209 (47)
Yes, probably		156 (35)
Don't know		55 (12)
o, probably not		18 (4)
No		5 (1)
Missing		0
Self-rating of predicted clinical competence		
Below Average		11 (3)
Average		109 (25)
Above Average		240 (54)
Don't know		74 (17)
Missing		10 (2)

[a]These questions were submitted only to students in years 3, 4 and 5

overly positive judgments ('illusory superiority') [46, 47]. This overconfidence is seen by psychologists as a self-deceiving, probably subconscious, mechanism that cushions a person from experiencing negative feelings [45]. This is probably a normal defence mechanism in a novel situation for many. Overconfidence has been found to be inversely related to diagnostic accuracy to a greater degree in medical practitioners than medical students [18]. However, in this study population, it would be difficult to investigate the association between self-rating and other factors, as there are not enough cases to compare over-rating to normal-rating or under-rating with participants' judgements clustering around normal and above. A comparison with chiropractic practitioners may clarify if this is the same as for chiropractic students.

Methodological considerations

Our questionnaire was developed to meet the needs of our objectives, it was pre-tested and refined. Two of the sets of questions (neck and low back pain questionnaires) have been previously used in research [9, 34]; both having been previously tested and refined. In addition, we used a validated questionnaire to measure IU [37].

The response rate was relatively good for one chiropractic program but not as strong for the other. Since the study was anonymous, we could not compare responders with non-responders. However, the profiles for IU were similar in the two programs. We therefore assume that the second smaller sample was not more biased in any particular direction than the larger sample.

The students' belief in the need for a technique system and their self-rated ability levels did not stratify on IU. It is possible that other psychological profiles would have been better suited to search for explanatory factors associated with different clinical practice styles. Different results may or may not have been found if other measures of chiropractic practitioners' profiles had been used or the study had been of practising chiropractors. Further, a very high proportion of favourable responses were obtained on the question that asked if students would adopt a prescriptive technique system. It is possible that this question was not as discerning as we intended. This single question was chosen after feedback from chiropractic academics, supervising clinicians and students. However, what may be required is a number of questions, as suggested by more recent research [44]; questions which more fully capture the unknown of clinical practice and thus improves the ability to discern the reasons for wanting to adopt such prescriptive technique systems.

It is also possible that our transformation of the outcome variables could have been performed differently and may have produced different results. We did not analyse the data by year of program, which could have revealed differing levels of knowledge across the year of

Table 3 Associations between Intolerance of Uncertainty and various clinical outcome variables in a study of Australian chiropractic students

Clinical outcome variables	Numbers of students with Normal IU N (%)	Numbers of students with High IU N (%)
[a]Neck Pain Scenario: Number of inappropriate referrals (*N* = 206)		
Acceptable	113 (71)	22 (48)
Unacceptable	47 (29)	24 (52)
χ^2 (1, *N* = 206) = 8.2, *p* = .004		
[a]Low Back Pain Scenario: Number of inappropriate choices of maintenance care (*N* = 198)		
Acceptable	109 (71)	29 (64)
Unacceptable	44 (29)	16 (36)
χ^2 (1, *N* = 198) = .76, *p* = .38		
[a]Low Back Pain Scenario: Number of inappropriate referrals (*N* = 200)		
Acceptable	136 (88)	37 (82)
Unacceptable	19 (12	8 (18)
χ^2 (1, *N* = 200) = .91, *p* = .34		
Preference for Technique System of Analysis (*N* = 432):		
Yes	247 (81)	108 (86)
Don't know/ No	60 (20)	17 (14)
χ^2 (1, *N* = 432) = 2.14, *p* = .14		
Self-rating of predicted clinical competence (*N* = 432)		
Below Average	7 (2)	4 (3)
Average	76 (25)	32 (25)
Above Average	177 (58)	63 (50)
Don't know	46 (15)	27 (21)
χ2 (3, N= 432) = 3.4, p = .33		

[a]these questions were only submitted to students in years 3, 4 and 5

program of chiropractic students and altered the results. However, this would have been unsuitable as the sample size would have become too small for reliable results when testing the various subgroups.

Conclusions and recommendations

This study suggests that IU is associated with chiropractic students' neck pain clinical decisions. If these decisions are unsuitable, this could have implications for health economics because it would result in unnecessary consumption of health resources. It could also, as shown in this study, have deleterious effects on patient safety due to delayed referral. However, IU does not impact all aspects of clinical practice.

The implications for teaching are that students with a high IU appear to make more mistakes on patients with neck pain than with low back pain, which indicates a need for educators to pay special attention to the cervical spine both in relation to indications and contraindications for treatment.

The implications for research are that future studies should refine our understanding of the impact of IU for the case management of low back pain. Also, to learn even more on this topic, it would be useful to test the effect of other psychological profiles and similar work would be relevant in the qualified chiropractor population.

Additional files

Additional file 1: Anonymous Questionnaire for Chiropractic Students' Survey. (DOCX 598 kb)

Additional file 2: Explanation of 'correct' and 'incorrect' designation for the neck and low back case scenarios. (DOCX 18 kb)

Abbreviations

IU: Intolerance of uncertainty; MQ: Macquarie University; MU: Murdoch University; SD: Standard Deviation

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SI, BW and CLY were responsible for the study design. SI and CLY undertook the data analysis and interpretation. SI and CLY developed the initial and iterative draft. BW and CLY were responsible for reviewing and redrafting the final manuscript. All contributed to the final version. All authors read and approved the final manuscript.

Ethics approval and consent to participate
Ethics approval was granted by Murdoch University Human Research Ethics Committee (Project No 2016/118).

Consent for publication
Not applicable.

Competing interests
Bruce Walker is Editor-in-Chief and Charlotte Leboeuf-Yde is Senior Editorial Adviser of the journal *Chiropractic & Manual Therapies*. Neither played any part in the assignment of this manuscript to Associate Editors or peer reviewers. They were separated and blinded from the editorial system from submission inception to decision. Bruce Walker is Head of the Council on Chiropractic Education Australasia (CCE-Australasia) accredited chiropractic program at Murdoch University in Perth, Western Australia and a Board member of the CCEA.

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Study: Chiropractic student choices in relation to indications, non-indications and contra-indications of continued care.

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Chiropractic student choices in relation to indications, non-indications and contra-indications of continued care

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Abstract

Background: The quality of health care provider clinical decisions has long been recognized as variable. Research has focused on clinical decision making with the aim of improving patient outcomes. No studies have looked at chiropractic students' abilities in this regard.

Method: In 2016, advanced students from two Australian chiropractic programs ($N = 444$) answered a questionnaire on patient case scenarios for neck and low back pain (LBP). We selected 7 scenarios representing the three categories; continuing care, non-indicated care, and contraindicated care. This represented a total of 21 tested scores. Comparisons of correct answers were made a) for program years 3, 4 and 5, and b) between the three categories of care.

Results: In almost 1/3 of scenarios, correct scores were 70% or greater. Best results were for two neck pain cases (simple and with spinal cord involvement). Continued care showed most improvements with study year. However, the scenarios that reflected non-indication for continued care had much worse results and did not improve in higher years. For the obvious contraindicated neck scenario, the results were good from the beginning and progressively improved and for a contraindicated LBP scenario the results started poorly in year 3 but improved over the program years.

Conclusions: Although student responses were generally good, there is still room for improvement, especially for non-indicated care. The quality of students' clinical decisions can be measured and thus has the potential to be used by chiropractic educators and regulatory bodies to identify student's in need of assistance as well as to monitor chiropractic programs in relation to student competence.

Trial registration: Not applicable.

Keywords: Clinical decisions, Diagnosis, Chiropractic, Education

Background

Quality care is a key aim for all healthcare systems [1, 2]. The most common domains used to measure healthcare performance are safety, effectiveness and access [3]. Undergraduate education for healthcare providers aims to produce competent graduates who can implement evidence-based and common sense care in order to meet expectations associated with safety and effectiveness [4].

Chiropractic students in Australia undergo programs which are 5 years in duration [5]. Like medical students, the early years are spent learning the basic sciences, after which they progress to the clinical sciences with the expectation that they will learn to apply this knowledge and make reasonable clinical decisions.

Clinician judgment has been described as being notoriously fallible, irrational and difficult to comprehend [6, 7]. As a result medical research has increasingly emphasized the need for evidence based medicine [8]. This is similar for many first or primary contact practitioners [9]. The difficulty of incorporating evidence continues to be a struggle and education is viewed as an important part of the solution [10]. To this end medical education authorities commonly use milestones for the purpose of

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standardizing expectations and providing clarity for both assessors and learners about their development across competency domains [11]. Information about this progression could be used to facilitate decisions regarding the educational quality and effectiveness of chiropractic programs. Further, it may identify directions for remedial intervention to assist chiropractic students, who are not making satisfactory progress.

While there are some variations between chiropractic regulatory authorities' accreditation standards, one common standard is the expectation that chiropractic undergraduate institutions will produce graduates capable of making decisions which are in the best interest of their patients [12–14]. They should for example be able to determine when treatment is indicated and when not. Thus they should be able to distinguish between indications, non-indications and contra-indications. Conditions indicated for treatments should be plausible, often experienced as successfully treated, and when possible evidence-based. Non-indications are conditions that are unlikely to respond in a positive manner to chiropractic treatment whereas contra-indications are those that might worsen with such treatment [15]. Thus back pain caused by an episode of dysmenorrhea is a non-indication, as it is not amenable through usual chiropractic care, whereas back pain caused by a spinal metastatic lesion is a contra-indication, as it could worsen (bony fracture) with a manipulative thrust.

During the course of treatment, chiropractors must also be able to make common sense choices of when they should continue and when they should stop. Conditions that do not improve, or progress to develop warning signs of contra-indications, should not continue to be treated. Non-indicated treatment, even if not contra-indicated, brings with it an unnecessary cost and reflects badly on any professional or profession. On the other hand, continued care, also called 'maintenance care' in the chiropractic context, is a logical choice in cases with a previous recurring history and good response to treatment [16, 17].

A word search by the authors of the five Councils on Chiropractic Education (CCEs), who are the regulatory agencies of the education and competency standards for chiropractic programs, found occurrences of the words 'indications' and 'contraindications' but none for 'non-indications'. The authors contend that this aspect of training requires a detailed discussion of all three terms. Further, that this is overdue and it would be relevant to start exploring how or if these issues manifest in the current educational setting.

It is reasonable to expect that chiropractic students, at an appropriate stage of training, attain the same level of good / correct clinical decision making as graduated chiropractors and that this would be a graded and positive process. Also likely is that students within each year may not uniformly attain this ability. For example, contraindications to stop care may be learned early on, but the recognition to stop non-indicated care may occur in later years with clinical experience.

Accordingly, our research questions were;

1. Is there a progression in chiropractic students abilities in different years of the program to correctly identify

a) The continuation of 'indicated' care in relation to a neck pain case with two scenarios and a LBP case scenario?
b) The cessation of 'non-indicated' care in relation to a low back pain case with two scenarios?
c) The cessation of 'contraindicated' care in relation to a neck pain case scenario and a LBP case scenario?

2. Is students' knowledge in each year of the program the same or different for understanding when treatment is 'indicated', 'non-indicated' and 'contraindicated'.

a) In year 3
b) In Year 4
c) In Year 5

Methods

Procedure

This is a secondary analysis of a study that has been reported in full elsewhere and is available as free full text online [18]. Two questionnaires on neck pain [19] and low back pain [20] were included in a survey on the association between psychological profiles and practice patterns, conducted towards the conclusion of the academic year (October and November) in 2016 [18]. The questionnaires have been previously used to assess chiropractors' clinical decision-making profiles [19–22]. Participants were chiropractic students from two chiropractic programs at two universities (Programs A and B) in Australia and the original research project required data from all the years [18]. For the purposes of this present study, only data from the third to the fifth years were included, as it was deemed that students in Years 1 and 2 did not have the clinical knowledge to understand the case scenarios used.

Ethics approval was granted by Murdoch University (Project No 2016/118) and the project was classed as a negligible risk research. The project followed the same protocols in both institutions, consent was obtained from students, data were non-identifiable (anonymous)

and permission was obtained from the Head of the other chiropractic program to conduct the survey. Accordingly, the study met the criteria for classification under the Australian National Statement on Ethical Conduct of Human Research (2007) (Sections 5.1.8 and 5.1.22) as exempt from requiring ethics approval from both universities.

Information used for this study

Information on various demographic details of the participants was obtained (chiropractic program, sex, year of study).

Survey instruments

Neck pain survey

In the first case study [19], five neck pain scenarios were presented, beginning with a simple uncomplicated case of neck pain and progressing through to a scenario requiring immediate medical referral (Additional file 1). The case consisted of the following general information: "A 28-year old man, tennis player by profession, consults you for a right-sided intense neck pain without any radiating pain. You note an antalgic position of the head, no other musculoskeletal signs (no torticollis), no other health problems in particular, normal x-rays for his age, and no signs of serious pathology (red flags)". There was a choice of six answers for each of the five scenarios ranging from the chiropractor treating the patient on their own, through to not providing treatment and arranging referral.

This questionnaire was originally designed by three 4th year chiropractic students, a lecturer in clinical sciences, and three lecturers in research methodology in France. French chiropractic academics proof-read the document for logic and absence of errors. Low percentages of "no response" in the original study indicated it was easy to understand and respond to. The questionnaire was translated into plain English for the purposes of publication and this version was used in our present survey.

The progression of this case was straightforward and the distinction between the simplest to the most severe case was clear, making it easy to define suitable and non-suitable clinical choices. Consensus was demonstrated in the previous study on the most appropriate management or 'indicated' choice across the five scenarios [19].

We selected scenarios 1 and 2 for the purposes of this study. Here the patient presented with simple uncomplicated neck pain. The continuation of only chiropractic care was clearly indicated. Consequently, it was designated as the 'indicated' or 'correct' choice.

We also selected scenario 5 for 'contraindicated' purposes. In this scenario the patient had been resistant to treatment and there was clear evidence of progressive neurological deterioration and symptomatology. Selection of any option other than the referral choice was deemed to be 'contraindicated' (the full rationale is seen in Additional file 1).

Low back pain survey

The second case study described a range of clinical scenarios for a patient with low back pain (LBP) and designed to find out which management strategies chiropractors would prefer to use [20] (Additional file 1). This questionnaire included nine possible outcomes that were briefly described. These nine clinical scenarios differed both on past history and reaction to treatment. An identical set of six clinical management alternatives were offered for each of the nine outcome scenarios, of which the respondents should choose one alternative for each scenario.

The LBP questionnaire was previously designed, written, distributed, answered and subsequently adjusted in English by a research team consisting of 7 chiropractors, with clinical experience ranging from 4 to 25 years, who obtained their chiropractic degrees in English speaking countries. They were supervised by a chiropractic researcher. The term 'treatment' used in the questionnaire was purposefully not defined so that it aligned with previous studies used [23].

In the first LBP survey conducted on Swedish chiropractors, a pattern of self-reported clinical management strategies was demonstrated which allowed identification of those who did and did not follow 'clinically logical' answers for this hypothetical case (Additional file 1) [20]. This was followed by a smaller interview study in Denmark using the same questionnaire which revealed the same pattern [21]. Thereafter, the same survey was conducted on French chiropractors, again, revealing a similar pattern [22]. The Swedish and Danish chiropractors responded to the questionnaire in English and the French chiropractors did so in French after a double translation (English to French; French to English).

The basic facts for this hypothetical patient were: "A 40-year old man consults you for low back pain with no additional spinal or musculoskeletal problems and with no other health problems. His X-rays are normal for his age. There are no 'red flags'."

The patient's possible response to initial treatment was provided (the scenarios), ranging from total and quick improvement to deterioration. The six clinical management alternatives in relation to the continued clinical strategy, from which the respondents could choose, included choices such as brief continued care, maintenance care, the seeking of additional assistance, and complete discharge from care. To answer the questions in this questionnaire the respondents needed to take more factors into account than with the neck pain questionnaire. We selected three scenarios (1, 4, 8 and 9) for this study.

Scenario 1 describes the attack of LBP as being of 2 days duration with no previous history of LBP with complete remission after 2 visits. The patient is uncomplicated and is able to self-manage. This case indicates a person without a background of persistent or recurrent LBP, with a quick recovery and a psychological profile that indicates a good prognosis. The 'indicated' choice was to discharge the patient as no further treatment or referral is required, i.e.; a "non-indication" of continued care. Students who chose to keep on treating this patient by selecting the options of 'maintenance care' or 'try something else' were thus designated as delivering 'non-indicated' treatment and would be best described as over-servicing.

Scenario 4 describes a patient who improves with treatment with a history of a few uncomplicated episodes of acute LBP that completely resolves. The correct choice in this case is to elect some form of 'maintenance care'., i.e. continued treatment is "indicated".

The patient in Scenario 8 is not really exhibiting a positive response to the treatment and is getting worse. A 12-month history of intermittent LBP and 6 consultations in 1 month with a worsening profile is not a normal pattern. Despite the fact that there are no (obvious) 'red flags' a referral for a second opinion because some type of underlying explanatory condition could have been missed, is the correct choice. Students who chose to keep on treating this patient by selecting the options of 'maintenance care' or 'try something else' were designated as delivering 'contraindicated' treatment.

In Scenario 9 the patient is not improved at all and there is no obvious (biomechanical) explanation for the intermittent pattern. There are no 'red flags' but there is a need to consider if there might not be an underlying depression or some other disease. A second opinion is required. Any continued treatment would be 'non-indicated' and would also be described as over-servicing.

Analysis

Data were entered and analysed in SPSS v.22 (IBM Corp, Armonk NY, USA) after identifying and correcting any incomplete or corrupt data. Survey items were dummy variable coded.

Responses to the two questionnaires were shown for general information but were not further discussed in this report. These were shown in tables, in which the "correct" answers were highlighted and the most commonly selected answers indicated in bold.

For the purpose of finding answers to our specific research questions, we selected items that most clearly would require care or that could be considered non-indications or contra-indications to continued care. Percentages were calculated for each of these responses and reported by year of study.

Thereafter, all correct answers for the 'indicated', 'non-indicated' and 'contraindicated' scenarios were displayed in a table as percentages together with their 95% confidence intervals (CIs).

Confidence intervals provide information about a range in which the true value lies with a certain degree of probability, as well as about the direction and strength of the demonstrated effect. This enables conclusions to be drawn about the statistical plausibility and clinical relevance of the study findings [24, 25].

We expected that Year 5 would have higher estimates than Year 3 and perhaps Year 4. Thus differences in estimates between study years and types of indications were identified and these were considered to be statistically significant if their 95% CIs did not overlap.

Results

Descriptive information

Of a possible 142 3rd, 4th and 5th year chiropractic students from Program A, 90 (63%) completed the survey and from Program B 124/ 518, giving a total of 214 students (41%), of which 54% were male (114) (Table 1). Because some students studied across multiple years and the manner in which these data were recorded at Program A, a few participants could not be placed within a specific year.

As reported elsewhere [18] there was no difference in the psychological variable scores between institutions or between sexes, whether tested by year of program or for the whole institutional sample. Consequently, the two programs were combined for all subsequent analyses.

General information

The results for the whole questionnaires are shown in Table 2 for the neck pain study and in Table 3 for the LBP study. Results for the research questions are found in Tables 4, 5 and 6.

Table 1 Institution, year of chiropractic program, sex and percentage of participants in a survey on Australian chiropractic students ($N = 214$)

Year of Program	Males/Females	% of respondents by year
3rd year Program A	42/20	**
Program B	19/22	62%
4th year Program A	34/25	**
Program B	6/21	79%
5th year Program A	3/0	**
Program B	12/10	55%
All Years Program A	79/45	**
Program B	37/52	44%

**Data could not be provided because of the inability to ascertain students' year of study

Table 2 Proportion of Australian chiropractic students in Years 3,4 and 5 participating in a survey on how to choose a treatment strategy for five different neck pain scenarios ($N = 214$). For ease of comparison, results from a previous study on French chiropractors [7] have been included

Case Scenario	Populations	Treat self %	Treat with paramedical %	Treat with GP /Medical Dr %	Treat with specialist %	Do not treat, refer %	Other %	No response %
1. Local neck pain	Students Year 3	80	5	9	3	2	1	1
	4	95	2	2	0	0	0	0
	5	100	0	0	0	0	0	0
2. Neck pain & radiates to tip of shoulder	Students Year 3	43	9	16	26	5	1	2
	4	58	7	11	15	9	0	2
	5	84	4	4	0	4	1	0
3. Neck pain & pain radiates to elbow, reduced C6 reflex	Students Year 3	16	8	10	40	25	1	2
	4	38	2	15	33	12	0	3
	5	29	8	33	25	4	0	0
4. No neck pain, but arm pain radiates to thumb, neurological C6 sign	Students Year 3	5	4	13	26	51	2	1
	4	11	5	2	36	47	0	0
	5	0	4	8	36	48	4	0
5. No neck pain, no arm pain & upper motor neurone lesions findings in lower limb	Students Year 3	0	5	6	12	74	3	1
	4	1	1	1	15	81	0	0
	5	0	0	4	8	84	4	0

The most common answer for each scenario has been written in bold. Shaded areas denote the a priori choices of the original research team as the correct or 'indicated' answer [19]. 'Paramedical' denotes an osteopath, physiotherapist nurse or another chiropractor

Overall impression

The percentages of 'correct' choices varied between the questions (43 to 100%). There were 7 scenarios reported for students in years 3, 4 and 5. This resulted in 21 scores of which 13 were correct in less than 70% of respondents and 8 in 70% or above of students.

Objective 1

(a) Is there a progression in chiropractic students' ability in different years of the program to correctly identify continuation of 'indicated' care?

For the three scenarios relating to indications for continuing care, the percentage scores of 'correct' choices for years 3, 4 and 5 ranged from 43% to 100%. Thus for nine scores, five were below 80% and four were 80% or above.

The 'correct' estimates increased for year of study in all three scenarios (Table 4). This was statistically significant as the 95% Confidence Intervals did not overlap when comparing the 3 years of study in these scenarios. This was not in a stepwise manner.

Thus, students were comfortable to continue to treat a simple case of uncomplicated neck pain. Likewise, they would continue treating a simple case of neck pain that

Table 3 Proportion of Australian chiropractic students in Years 3, 4 and 5 participating in a survey on how to choose a treatment strategy for nine different low back pain scenarios ($N = 214$)

Case scenarios	Populations	A 2nd opinion (%)	B External help, keep in touch (%)	C Quick-fix (%)	D Try again (%)	E Symptom guided maintenance care (%)	F Clinical findings-guided maintenance care (%)
1	Students Year 3	3	2	62	1	20	10
	4	3	2	64	4	23	4
	5	0	0	52	0	40	8
2	Students Year 3	2	1	31	5	45	16
	4	1	1	41	8	40	9
	5	4	4	8	4	64	16
3	Students Year 3	12	20	5	38	14	0
	4	10	8	2	52	19	1
	5	24	4	0	44	20	0
4	Students Year 3	7	5	22	4	42	19
	4	0	5	30	8	48	8
	5	0	8	4	0	68	20
5	Students Year 3	20	19	10	18	22	11
	4	13	18	2	40	19	7
	5	24	16	0	20	32	8
6	Students Year 3	18	17	5	38	18	5
	4	23	19	2	44	7	3
	5	20	12	0	44	16	8
7	Students Year 3	16	27	3	39	13	3
	4	32	17	4	37	7	2
	5	29	8	0	46	8	4
8	Students Year 3	45	25	0	20	10	0
	4	56	16	2	19	6	0
	5	68	8	0	20	4	0
9	Students Year 3	53	25	4	6	5	6
	4	51	29	1	10	5	4
	5	58	33	0	0	4	4

The most common answer for each scenario has been written in bold. Shaded denotes the a priori choices of the original research team as the correct answers for each scenario [20]. High scores that do not match the pre-selected 'correct' treatment strategies are also presented but are not shaded

Table 4 Three case scenarios for which continued care would be the correct choice in a survey of 214 Australian chiropractic students

Case Scenarios	Population	'Correct' response	
		N (%)	[95% CI]
Neck Scenario 1	Students	81 (80)	[71–88]
Simple uncomplicated neck pain	Year 3	82 (95)	[89–99]
	4	25 (100)	[86–100]
	5		
Neck Scenario 2	Students	43 (43)	[33–53]
Simple uncomplicated neck pain with pain in the trapezius	Year 3	50 (58)	[47–69]
	4	21 (84)	[64–96]
	5		
LBP Scenario 4	Students	58 (61)	[51–71]
Recurrent LBP over 12 months with previous episodes and complete recovery	Year 3	48 (57)	[46–68]
	4	22 (88)	[69–98]
	5		

spreads to the trapezius muscle. Finally, students knew to continue to treat a patient who completely recovered from an episode of LBP with a history of previous episodes.

(b) Is there a progression in chiropractic students' ability in different years of the program to correctly identify the need for the cessation of 'non-indicated' care?

The percentage scores for the two scenarios relating to stopping 'non-indicated' care ranged from 51 and 64%. Two were above and four were below 60%.

The 'correct' estimates did not increase for year of study in these two scenarios (Table 5). Specifically, students did not improve in selecting the 'correct' choice of stopping 'non-indicated' care in a patient without a previous history of LBP, which had recovered completely within two visits from an acute episode. Nor did they do well in the LBP case where there was an absence of improvement for no apparent reason, but probably due to or concomitant to depression.

Table 5 Two case scenarios for which continued care would be not be indicated ('non-indicated') in a survey of 214 Australian chiropractic students

Case Scenarios	Population	'Correct' response	
		N (%)	[95% CI]
LBP Scenario 1	Students	62 (63)	[53–73]
Complete recovery with no previous episode	Year 3	55 (64)	[53–74]
	Year 4	13 (52)	[31–72]
	Year 5		
LBP Scenario 9	Students	51 (53)	[43–63]
Absence of improvement for no apparent reason, probably concomitant depression	Year 3	42 (51)	[40–62]
	Year 4	14 (58)	[35–76]
	Year 5		

Table 6 Two case scenarios for which continued care would be contraindicated in a survey of 214 Australian chiropractic students

Case scenarios	Population	'Correct' response	
		N (%)	[95% CI]
Neck Scenario 5	Students	75 (74)	[65–82]
Neck pain & arm pain gone but Upper Motor Neuron lesion findings present in the lower limbs	Year 3	70 (81)	[72–89]
	4	21 (84)	[70–98]
	5		
LBP Scenario 8	Students	43 (45)	[35–55]
Absence of improvement and worsening pain	Year 3	47 (56)	[45–68]
	Year 4	17 (68)	[47–85]
	Year 5		

(c) Is there a progression in chiropractic students' ability in different years of the program to correctly identify the need for the cessation of 'contraindicated' care?

For the two scenarios that related to 'contraindicated' care, 'correct' percentages ranged from 45 to 84%. The scores for the LBP scenario were all below 70% while all the neck pain scores were 70% or above.

The 'contraindicated' estimates increased with year of study in both scenarios but not significantly. This means that it is possible that students improve in their ability to correctly stop 'contraindicated' treatment but that this did not show for a patient who deteriorates with neck pain to develop absence of neck pain or arm pain but has upper motor neuron lesion findings in the lower limbs. Likewise for the LBP case, where the patient does not improve but worsens.

Despite these obvious contraindications to continue care, between 23% (Year 3) and 12% (Year 5) were still prepared to keep on treating the neck and as many as 55% (Year 3) and 32% (Year 5) would continue with the LBP case.

Objective 2. Do students understand equally well when treatment is 'indicated','non-indicated' and 'contraindicated'.

a) In year 3
b) In Year 4
c) In Year 5

Overall impressions

As can be seen in Tables 4, 5 and 6, for all the 3 years, by far the best responses were for the simple neck pain scenario, which the vast majority considered a good indication for continued care. The second best scenario was the most severe neck profile with findings of an upper motor neuron lesion. Findings in addition to this are reported below.

2 (a) 3rd year chiropractic students;

Students were by far best at detecting an indication for continued care in the simple uncomplicated neck pain scenario (80%). However, the addition of pain in the trapezius was spotted by less than half as an indication (43%). That absence of LBP improvement with probable depression is a non-indication for continued care was understood by 53% and that absence of improvement with worsening of pain was actually a contraindication was understood by only 45%.

2 (b) 4th year chiropractic students;

Again the LBP non-indication and contraindication were not recognised by almost half, 51% and 56% correct answers, respectively. In addition, only 64% acknowledged that the person with LBP, complete recovery and no previous episodes was not an indication for continued care.

2 (c) 5th year chiropractic students;

The fifth year students, however, were very good at knowing when to continue care (88 to 100%), reasonable at understanding that LBP that fails to improve and gets worse is a contraindication to care (68% correct answers) but often unable to identify non-indications (52 and 58% correct answers).

Post hoc analyses

Post hoc analyses of all variables per year of study were done, cross-tabulating all variables in two by two tables, which in general revealed no associations between individuals who gave the incorrect answer in one scenario and an incorrect answer in the others (data not shown).

Discussion

Summary of findings

This appears to be the first study to investigate clinical reasoning in chiropractic students. For this we used two clinical cases, one on LBP and one on neck pain, with different scenarios that indicated that patients should either receive continued care, were unsuitable for continued care because it would be ineffective, or that care was likely to worsen the condition or markedly prevent other necessary treatment, hence contraindicated.

We found that students were good at identifying indications to continue care and that the results, generally, got better with year of study. However, the scenarios that reflected non-indication for continued care had much worse results and did not improve in higher years. Encouragingly, for an obvious contraindicated neck scenario, the results were good from the beginning and got better but for a contraindicated LBP scenario the results started rather badly in year 3 then improved over the program years.

Incorrect clinical choices did not cluster around the same students to a significant extent.

Explanation of findings

The best results were attained for extreme cases, especially for the neck scenario with pathological sign posts. The LBP cases required decisions without any such 'hard' clinical evidence. Rather, they were based on more equivocal symptoms such as the number of past episodes and fluctuating levels of improvement. It is therefore possible that the students, who had little or no clinical experience, would struggle to find the 'correct' answers.

The students got better at choosing to continue care but they also considered continued care when this was not indicated. Research with medical students has suggested they become over confident with training [26]. This may be an explanation for this finding in chiropractic students. In fact, students from all years were not good at stopping 'non-indicated' care. It therefore seems that the educative process has been unable to prepare approximately half of the students, who were probably of the attitude "try it and see how it goes" for 'non-indicated care'. Another explanation is that students were not taught when to stop. Some may not regard this as a safety issue or being acutely dangerous but unwarranted treatment has financial implications for the patient and society and runs the risk of entrenching pain behaviours and practitioner dependence if continued for a protracted period. In other words, this invites overservicing. If this is the case, chiropractic educators may need to face the challenge of training chiropractic students about the more subtle aspects of patient care as well as developing a healthy self-doubt.

As stated in the introduction, CCE accreditation standards have little regulatory expectations of chiropractic programs using the specific terms contraindicated or non-indicated care. A positive step would be the adoption and enforcement of these terms into the standards of CCEs and their inspection processes. Perhaps this could address the genesis of deficient chiropractic practices and profiles, such as a minority of students believing that disease is caused by 'vertebral subluxation complexes' and that chiropractic spinal adjustments are an effective primary treatment for diseases including AIDS and cancer [27].

Some chiropractors use so called maintenance care as secondary or tertiary prevention. However there are wide variations in its use [28]. Some have few maintenance care patients while others have many [29]. No doubt, based on common sense there seems to be a consensus for when ongoing care is indicated. This was confirmed in a survey which showed that maintenance care is thought to be useful for patients who improve well with treatment and have a history of repeat episodes [30]. On the other hand, for patients with no past episodes, maintenance care is not indicated, nor is it indicated when there is no improvement [28].

From an educational perspective, it is our observation that clinical chiropractic education centres on the initial screening of patients to avoid contraindications to care. Once this step is achieved then there is emphasis on the technical diagnosis, i.e. where the problem is and how to treat. But perhaps we do not place adequate emphasis on the different clinical trajectories observed or explaining and discussing what to expect and how to match our treatment approach including the cessation of care. This is important as LBP, for example, has several types of trajectories [31–33] and each should be considered from a common sense point of view, as, generally, there is no evidence on what sort of approach is best for which type of trajectory.

Concerns

Despite these encouraging results, it is of concern that in our student sample approximately 20% would not stop treatment when there were serious neurological signs present [19]. This suggests that there is scope for future investigations exploring how educators could best construct educational interventions, which address these types of clinical scenarios.

We contend that common sense is a valuable clinical asset and that the discontinuation of care for a non-responsive patient clearly falls into this domain. The fostering of such an approach may go a long way to addressing the perception of over servicing.

None of the five Councils on Chiropractic Education used the term 'non-indication' in their accreditation standards. This study suggests that incorporation of the words 'indication', 'contraindication' and 'non-indication' is warranted at this level and may offer an assessable metric for use as an outcome measure for program evaluation and monitoring student progression. Consequently, it has the potential to produce more responsible graduates and enhance the public perception of chiropractic care.

Methodological considerations

This study was cross-sectional in nature. It is therefore possible, but not likely, that the results in the different years can be explained by a cohort effect. Further studies would reveal if this is the case.

The two sets of questions (neck and LBP questionnaires) were tested and refined prior to being used in previous studies [19, 20], which supports their user-friendliness and clinical relevance. However, the two questionnaires used different formats, and it is possible that the LBP questionnaire was more difficult for students, who do not have enough clinical experience to be able to deal with several issues or aspects at the same time.

The response rate was relatively good for one chiropractic program but not so for the other. Since the study was anonymous, we could not compare responders to non-responders. However, the profiles on other factors were similar in the two programs [18]. We therefore assume that the two student samples were not biased in any particular direction. Whether they were entirely representative of their study populations is not known.

Overall, there was a small number of 5th year students. This created wide confidence intervals that may have impacted on our findings. A larger study using Australian chiropractors would clarify this and the impact clinical experience may have on some of the scenarios for the neck and LBP case.

Conclusion

Students generally made appropriate clinical choices for when to treat. This was also the case for contraindications especially when there are obvious pathological findings. These skills were more apparent in the higher years of study. However, the concept of non-indication may not have been as well understood and did not differ between the years. This is surprising, as non-indications are essentially common-sense decisions.

Recommendations

CCEs should adopt the terms contraindication, indication and non-indication in their accreditation standards to improve decision making on whether or not to continue care. This study suggests that there are ways to measure these indicators and that it could be used as evidence of undergraduate and graduate competency.

If student milestones require such knowledge, then more emphasis in education should be put on the indications for long-term management, especially in relation to past history and treatment outcome to avoid delivering unnecessary care.

There was a lack of improvement over the program duration for 'non-indicated' care. One way for chiropractic educators to improve this may be to teach the students to take a common sense approach to help students understand this concept better, including their use as a valuable clinical asset.

Additional files

Additional file 1: Anonymous Questionnaire for Chiropractic Students Survey. (DOCX 533 kb)

Abbreviations

GP: General or Medical Practitioner; LBP: Low back pain; UMN: Upper Motor Neuron

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Authors' contributions
SI and CLY were responsible for the study design. SI and CLY undertook the data analysis and interpretation. SI and CLY developed the initial and iterative draft. BW and CLY were responsible for reviewing and redrafting the final manuscript. All contributed to the final version. All authors read and approved the final manuscript.

Ethics approval and consent to participate
Ethics approval was granted by Murdoch University Human Research Ethics Committee (Project No 2016/118).

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Study: How frequent are non-evidence-based health care beliefs in chiropractic students and do they vary across the pre-professional educational years.

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Chiropractic & Manual Therapies

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How frequent are non-evidence-based health care beliefs in chiropractic students and do they vary across the pre-professional educational years

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Abstract

Background: Evidence suggests that a students' beliefs already prior to entering a program may be important as a determinant in sustaining unsuitable health care beliefs. Our objectives were to investigate the proportion of Australian chiropractic students who hold non-evidence-based beliefs in the first year of study and the extent to which they may be involved in non-musculoskeletal health conditions. Finally, to see if this proportion varies over the course of the chiropractic program.

Method: In 2016, students from two Australian chiropractic programs answered a questionnaire on how often they would give advice on five common health conditions in their future practices as well as their opinion on whether chiropractic spinal adjustments could prevent or help seven health-related conditions.

Results: From a possible 831 students, 444 responded (53%). Students were highly likely to offer advice (often/quite often) on a range of non-musculoskeletal conditions. The proportions were lowest in first year and highest the final year. Also, high numbers of students held non-evidence-based beliefs about 'chiropractic spinal adjustments' which tended to occur in gradually decreasing in numbers in sequential years, except for fifth year when a reversal of the pattern occurred.

Conclusions: New strategies are required for chiropractic educators if they are to produce graduates who understand and deliver evidence-based health care and able to be part of the mainstream health care system.

Keywords: Chiropractic, Education, Evidence-based, Beliefs, Scope of practice

Background

Chiropractic educational regulatory agencies uniformly aim to produce graduates capable of best practice care and interdisciplinary collaboration [1]. Arguments have also been voiced for chiropractors to become known as non-surgical spinal care experts [2]. However, studies have shown the existence of aberrant chiropractic practice profiles which include anti-vaccination beliefs and excessive X-ray usage [3]. Further these chiropractic practices consider 'wellness care' to be a main component of practice and treat a high number of asymptomatic patients for somato-visceral conditions [3, 4]. This type of profile is considered 'unsuitable' within the context of contemporary evidence-based health care [5] and, not surprisingly, chiropractors with profiles like this were less likely to receive referrals from or make referrals to medical practitioners than those whose main sector of activity was more musculoskeletal based with profiles such as treating sports injuries and prescribing exercises [4].

These unsuitable practice profiles are based on beliefs which are not biologically plausible nor are they supported by available evidence. Some specific examples of this are beliefs that spinal manipulation can influence the immune system, improve Attention Deficit Disorder or somato-visceral conditions [6]. It is logical to assume that, since all chiropractors were once students, education may play a role in this and the logic is not without

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evidence. One study has found that unsuitable views in chiropractic practitioners can be traced back to their college of education [7]. To further this proposition, evidence of these unsuitable beliefs has been shown in chiropractic students. A survey of one North American chiropractic program [8] revealed that 11% of students agreed or strongly agreed that all disease is caused by 'vertebral subluxation complexes' and that chiropractic spinal adjustments are an effective primary treatment for AIDS (9%), cancer (12%), depression (44%), inner ear infections (59%), and asthma (61%). Finally, 80% of the students in that study believed that all patients should have lifetime chiropractic care. Clearly this profile is not in the best interests of patient safety, quality care, or public health.

However, 3 in every 4 of these chiropractic students were found to rate evidence as more important than traditional chiropractic theory (vertebral subluxation complexes) [8]. If evidence is the most important determinant, how is it possible to have non-evidence based or unfounded beliefs that appear biologically implausible? This suggests that either students may not be taught how to recognize and understand the evidence or are refusing to integrate evidence which is at odds with their perceived professional identity. Other explanations may also be possible.

It is unknown if these unfounded beliefs are the same internationally. At first glance it would appear not. A study comparing Australian health care students in the final year of chiropractic, medicine, physiotherapy / physical therapy, occupational therapy and pharmacy found that the chiropractic students were most likely to offer guideline-consistent recommendations as well as possess the most helpful beliefs about LBP and impairment [9].

These international variations could perhaps be explained by differing cultures or educational standards. This is plausible, as we have previously found variations between the accreditation standards of the regulatory bodies who oversee the chiropractic programs in the USA, Australia, Europe and Canada [1, 10]. Research confirms the phenomenon that it is possible for students to hold views, like those cited above, but still offer guideline-based care [11]. This implies that chiropractic students, even if they are prepared to offer guideline based care, may also hold unreasonable beliefs in other areas. However this specific possibility has not been studied.

The aim of this research is to perform an exploratory study into Australian chiropractic students' views on various aspects of chiropractic practice that appear lacking plausibility and/or evidence. Specifically, we were interested in the following questions:

1. Do Australian chiropractic students believe that upon graduation they should involve themselves in the management of non-musculoskeletal disorders?
2. Do Australian chiropractic students believe chiropractic treatment will have preventive effects on various conditions?
3. If there is a proportion of students who hold these beliefs (1–3), does the proportion vary over the 5 years of the chiropractic program?

Methods

Study procedure

A cross-sectional study was carried out. The entire student population at two chiropractic programs within Australian Universities (Murdoch and Macquarie universities) were used for data collection between October and November in 2016. An anonymous class-room handout questionnaire was chosen as the instrument of measurement, as it facilitated the collection of a large amount of robust data in a timely and cost-effective manner.

A team consisting of the three authors were responsible for the design of the questionnaire and four 4th year chiropractic students from Murdoch University assisted with the survey administration and data collection. Recruitment, data administration, and collection of questionnaires were provided by administrative staff at the two universities.

Ethics approval was granted by Murdoch University Human Research Ethics Committee (Project No 2016/118).

The questionnaire

The survey contained four sections and was too large to present in one study. The results of some sections have been reported elsewhere [12]. For this study two of these sections were used (Additional file 1).

The first section sought demographic details (chiropractic program, sex, year of study). The second section had two sets of questions in order to address our objectives on the prevalence of non-evidence-based beliefs in chiropractic students (Additional file 1).

The first set of questions in this section asked students how often they would give advice to patients in their practices for five common health conditions: stress, cardiovascular disease, diabetes, musculoskeletal (MSK) problems, and wellness in general. Their response options were "No or rarely", "Sometimes" or "Quite often or often". Some of these health conditions were within the scope of chiropractic practice (e.g. musculoskeletal problems) whilst others were not (e.g. diabetes). Therefore, it would be considered unsuitable to provide frequent advice on the former conditions rather than on the latter. This was to gain an insight into students' understanding of chiropractic care, as indicated by how often they would provide advice on matters inside and outside their scope of practice. It was assumed that chiropractic students would be more likely to offer advice on musculoskeletal conditions as this is the major component of the curriculum. Other

health conditions are taught to inform diagnosis and appropriate management of musculoskeletal conditions. For example, people who have diabetes may have delayed recovery times. The training does not encompass the full range of clinical tests for diagnosis and appropriate pharmacological management. Appropriate diet [13] and exercise [14] have been shown to have therapeutic benefits and could be reasonably included in an initial assessment and on-going monitoring by a chiropractor. However full dietary assessment, monitoring of blood sugar levels and appropriate insulin dosage would not be and should rather be met by a number of specialist resources and practitioners available to people with diabetes in Australia. Consequently we would expect students responses to be more frequently "no or rarely" or "sometimes" to the question on non-musculoskeletal conditions.

The second set of questions in this section asked students for their opinion as to whether 'chiropractic spinal adjustments (CSA)' could prevent or help seven health-related conditions. These conditions were selected by the authors from previous research reports, which had identified them as being indicative of unsuitable practice profiles [3, 4, 7]. These health issues were biologically implausible, without any supportive evidence and therefore outside the scope of chiropractic practice, such as "chiropractic spinal adjustments can prevent disease in general [15–17]", "... help the immune system [18]", "... make it easier to give birth [19–21] and improve the health of infants [22–25]". The other conditions were related specifically to spinal care and also were contrary to, or without supportive evidence [24, 26–28]. These included, for example: "can chiropractic spinal adjustments prevent degeneration of the spine and chronic back pain?" The response options were "Definitely not", "Probably not", "I don't know", "Yes, probably" and "Yes, definitely". We considered the two last options as unsuitable.

Procedure

The contents and wording of the questionnaire were pilot tested on a small number of chiropractors and then on a small number of students. After each testing, some wording and lay-out changes were made in response to this feedback to make the questionnaire more user-friendly.

Students in both chiropractic programs were informed of the nature of the project during class time or through distribution of an information brochure and that participation was voluntary and anonymous. The survey was distributed at the end of class time and students were informed of a designated return location. Ethics approval was granted by Murdoch University (Project No 2016/118) and was classed as negligible risk research.

The project followed the same protocols in both institutions, consent was obtained from students, data were non-identifiable (anonymous) and permission was obtained from the Head of the Macquarie University chiropractic program to conduct the research. Accordingly, the study met the criteria for classification under the National Statement on Ethical Conduct of Human Research (2007) (Sections 5.1.8 and 5.1.22) as exempt from requiring ethics approval from both Universities.

Variables of interest and analysis of data

Data were entered and analysed in SPSS v.22 (IBM Corp, Armonk NY, USA) after having been cleaned. Survey items were dummy variable coded and descriptive statistics generated.

Outcome variables

1. Advice given to all patients - five health-related conditions
2. Excessive belief in chiropractic spinal adjustments – seven health-related conditions

The intention was to visually examine the responses of the participants on both research questions by tabulating them on a student year of study basis. Percentages were calculated for each of the responses to the two sets of questions and reported by year of study with their 95% confidence intervals (CI). These were shown in tables. We then sought to compare the responses between each year to see if there were any trends or if they differed. Consequently any differences in estimates between study years were identified and these were considered to be statistically significant if their 95% CIs did not overlap.

Preliminary analysis of the second set of questions 'Belief in CSA' revealed some of the "Definitely not" and "Yes, definitely" groups to be very small. Accordingly, we combined these responses with the "Probably not" and "Probably yes" groups respectively as we considered both types of responses to be indicative of disagreeing or agreeing.

Also, because of the small number of participants in the fifth year and the potential for that to impact on our results (particularly at MQ), we decided to conduct two analyses. In the first analyses, we combined the fourth and fifth year responses, assuming both years to be fairly similar in relation to their knowledge base on these health conditions. In the second analyses, the responses were calculated independently for each year, with the assumption that the final year students might change their opinions in view of their imminent entrance into the community as qualified health care professionals.

Results

Descriptive data

Out of a total of 831 possible participants in both programs, an overall response rate of 53% was obtained. As can be

seen in Table 1, from a possible 313 Murdoch University chiropractic students, 216 (69%) chose to participate, while out of a possible 518 Macquarie University chiropractic students, 228 (44%) completed the surveys, giving a total of 444 students of whom 224 were males (50%). The two programs were combined in the analyses on the basis that there was no significant difference between the two programs on psychological and demographic variables. This has been reported elsewhere [12] .

Advice given to patients

Analyses with years 4 and 5 combined

Students in year 1 were found to have the lowest proportions of selecting 'often / quite often' of all the years for providing advice on all five 'out of scope' health conditions, whilst the students in years 4/ 5 had the highest proportions (see Table 2). There was no overlapping of the 95% CI for the 'often, quite often' response when comparing the estimates for the 1st year students to the combined estimates for 4th and 5th year students for 'prevention of stress', 'cardiovascular disease' and 'diabetes'. This gradual increase was generally linear as the proportions tended to be incrementally higher in each successive year, the only exception being for musculoskeletal conditions. For students within their final 2 years of study, their lowest proportions were for the prevention of diabetes and cardiovascular disease, but these proportions were still higher than in the early years.

Years 1 through 5 analyses

As can be seen in Table 2, the 5th year students' response proportions as compared to the earlier years did not follow the pattern of a gradual increase about giving advice on the health conditions of 'cardiovascular disease' and 'diabetes'. For both conditions the proportions of students' responses in years 1, 2, 3, and 4 gradually increased for 'often / quite often' and decreased for the response 'sometimes' and 'no, rarely'. The 95% CI did not overlap for the 1st year students when compared to the 5th year students indicating that this difference was statistically significant. However, the 5th year students' responses had a reverse pattern or remained constant when compared to the earlier years.

Table 1 School, sex, and year of program

Year of Program	Males/Females	Response Rate by Year
	n	(%)
1st year MQ	43/34	**
MU	31/45	62%
2nd year MQ	17/10	**
MU	17/33	46%
3rd year MQ	42/20	**
MU	19/22	62%
4th year MQ	34/25	**
MU	6/21	79%
5th year MQ	3/0	**
MU	12/10	55%
All Years MQ	139/89	69%
MU	85/131	44%

** denotes information could not be provided because of the inability to ascertain students' exact year of study

Belief in chiropractic spinal adjustments

Analyses with years 4 and 5 combined

At least 7 out of every 10 chiropractic students in their final 2 years selected 'yes, probably / definitely' for the belief that CSA could prevent chronic back pain and help the body function at 100% of its capacity (see Table 3). Almost half of the years 4 and 5 students also selected this response for CSA being able to help the immune system, improve the health of infants, make it easier to give birth and prevent degeneration of the spine. Finally, almost one in five of the chiropractic students in these final years selected 'Yes, probably / definitely' that CSA could prevent disease in general.

At least 1 in 4 of these students in the final years of the program responded 'Don't know' to the question can CSA 'prevent disease in general', 'help the immune system' and 'make it easier to give birth'.

A lower proportion of students in their final years of study compared to students in the first year of study selected 'Yes, probably / definitely' that CSA could prevent 'disease in general', 'prevent chronic back pain', 'help the immune system', and 'prevent degeneration of the spine', respectively. The 95% CI did not overlap for 'disease in general', 'prevent chronic back pain' and 'prevent degeneration of the spine' indicating that this difference was statistically significant.

However, a higher proportion of students in their final years of study compared to students in the first year of study, believed that CSA could either 'definitely not or probably not' prevent or help any of the conditions except for 'help the body function at 100%'. This was statistically significant for 'prevent degeneration of the spine'.

Years 1 through 5 analyses

As can be seen in Table 3, the proportions of 5th year students who would respond 'Definitely / probably not' were consistently smaller than the proportions of the 4th year students (regardless of the question), while in contrast the proportions for the response 'Definitely / probably yes' were consistently larger. This reverses the general pattern of gradually decreasing levels of non-evidence-based beliefs in students up until the 5th year, when the pattern reverses and the proportions increase.

Table 2 Responses of Australian chiropractic students to the question of how often they would provide advice on a list of conditions in their future chiropractic practices reported separately for students in years 1 to 5, as well as in years 4 and 5 combined ("4/5")

Question: In your practice will you give advice on …	*N*	Year	No or rarely	Sometimes	Quite often, Often
			n (%) [95% CI]	*n* (%) [95% CI]	*n* (%) [95% CI]
Prevention of stress:	153	1	10 (7) [3–12]	70 (46) [37–54]	73 (48) [40–56]
	77	2	5 (7)[2–15]	24 (31) [21–43]	48 (62) [51–73]
	103	3	5 (5) [2–11]	29 (28) [20–38]	69 (67) [57–76]
	86	4	0 (0) [0–4]	23 (27) [18–37]	63 (73) [63–82]
	25	5	1 (4) [1–20]	4 (16) [4–36]	20 (80) [59–93]
	111	4/5	1 (1) [0–5]	27 (24) [17–33]	83 (75) [67–83]
Prevention of cardiovascular disease	153	1	31 (20) [14–28]	62 (41) [33–49]	60 (39) [31–47]
	77	2	12 (16) [8–26]	35 (46) [34–57]	30 (39) [28–51]
	103	3	5 (5) [2–11]	37 (36) [27–46]	61 (59) [47–67]
	86	4	3 (4) [1–10]	18 (21) [13–31]	65 (76) [63–82]
	25	5	2 (8) [1–26]	6 (24) [9–45]	17 (68) [47–85]
	111	4/5	5 (5) [2–10]	24 (22) [14–30]	82 (74) [65–82]
Prevention of diabetes	153	1	41 (27) [20–35]	58 (38) [30–46]	54 (35) [28–43]
	77	2	13 (17) [9–27]	34 (44) [33–56]	30 (39) [28–51]
	103	3	6 (6) [2–12]	38 (37) [28–47]	59 (57) [47–67]
	86	4	2 (2) [0–8]	23 (27) [18–37]	61 (70) [60–80]
	25	5	1 (4) [1–20]	8 (32) [15–54]	16 (64) [43–82]
	111	4/5	3 (3) [1–8]	31 (28) [20–37]	77 (70) [60–78]
Prevention of musculoskeletal problems	153	1	0 (0) [0–2]	4 (3) [1–7]	149 (97) [93–99]
	77	2	1 (1) [0–7]	6 (8) [3–16]	60 (78) [67–87]
	103	3	0 (0) [0–3]	4 (4) [1–10]	99 (96) [90–99]
	86	4	0 (0) [0–4]	2 (2) [0–8]	84 (98) [92–100]
	25	5	0 (0) [0–14]	0 (0) [0–14]	25 (100) [86–100]
	111	4/5	0 (0) [0–3]	2 (2) [0–6]	109 (98) [94–99]
Wellness in general	153	1	1 (1) [0–4]	31 (20) [14–28]	121 (79) [72–85]
	77	2	1 (1) [0–7]	11 (14) [7–24]	65 (71) [74–91]
	103	3	0 (0) [0–3]	16 (16) [9–24]	87 (85) [76–91]
	86	4	0 (1) [0–6]	10 (12) [6–20]	75 (87) [78–93]
	25	5	0 (0) [0–14]	3 (12) [3–31]	22 (88) [69–98]
	111	4/5	1 (1) [0–5]	13 (12) [6–19]	97 (87) [78–94]

Discussion

Summary of findings

This is the first study to identify the frequency of non-evidence based beliefs in Australian chiropractic students. We also compared the proportions which hold these beliefs in each of the 5 years of the program. By the time they were ready for graduation, at least 2 in 3 of the chiropractic students saw themselves as sufficiently trained to advise patients 'often' on a range of non-musculoskeletal conditions. Final year students were approximately twice as likely to think this way as compared to first year students.

However, at least half of the chiropractic students also held non-evidence-based beliefs on the effects of CSA on 6 of the 7 health conditions that were illogical and unsupported with evidence. In general, the proportion of students in their final 2 years of the program, when compared to respondents from earlier years, were lower in these non-evidence-based beliefs. Nevertheless, the fifth-year students, specifically, demonstrated a reversal of the profiles observed in years 1 through to 4 for these beliefs. In other words, a larger proportion tended towards the more non-evidence based approaches in their final year.

Table 3 Opinions of chiropractic students on chiropractic spinal adjustments from years 1 through to 5, as well as the combination of years 4 and 5 ("4/5")

Question: In your opinion, can chiropractic spinal adjustments	*n*	Year	Definitely not Probably not *n* (%)[95% CI]	Don't know *n* (%)[95% CI]	Yes, probably Yes, definitely *n* (%)[95% CI]
Prevent disease in general	153	1	64 (41) [34–50]	39 (26) [20–33]	50 (33) [25–41]
	77	2	31 (40) [29–52]	23 (30) [20–41]	23 (30) [20–41]
	103	3	41 (40) [30–50]	21 (20) [13–30]	41 (40) [30–50]
	86	4	55 (64) [53–74]	17 (20) [12–30]	14 (16) [9–26]
	25	5	10 (40) [21–63]	10 (40) [21–63]	5 (20) [7–41]
	111	4/5	65 (59) [49–68]	27 (24) [17–33]	19 (17) [11–25]
Prevent chronic back pain	153	1	2 (1) [0–5]	1 (1) [0–4]	150 (98) [94–99]
	77	2	1 (1) [0–7]	5 (7) [2–15]	71 (92) [84–97]
	103	3	2 (2) [0–7]	10 (10) [5–17]	90 (88) [79–93]
	86	4	5 (6) [2–13]	6 (7) [3–15]	75 (87) [78–93]
	25	5	1 (4) [0–20]	2 (8) [1–26]	22 (88) [69–98]
	111	4/5	6 (6) [2–11]	8 (7) [3–14]	97 (87) [78–93]
Help the immune system	153	1	30 (20) [13–27]	34 (22) [16–30]	88 (58) [49–66]
	77	2	12 (16) [8–26]	19 (24) [16–36]	46 (60) [48–71]
	103	3	24 (23) [16–33]	29 (28) [20–38]	50 (49) [39–59]
	86	4	27 (31) [22–42]	22 (26) [17–36]	37 (43) [32–54]
	25	5	2 (8) [1–25]	10 (40) [21–61]	13 (52) [31–72]
	111	4/5	29 (26) [18–35]	32 (29) [21–38]	50 (45) [36–55]
Make it easier to give birth	153	1	21 (13) [9–20]	57 (37) [30–45]	75 (49) [41–57]
	77	2	7 (9) [4–18]	24 (31) [21–43]	46 (60) [48–71]
	103	3	16 (16) [9–24]	33 (32) [23–42]	54 (52) [42–62]
	86	4	17 (20) [12–30]	31 (36) [26–47]	38 (44) [34–55]
	25	5	1 (4) [0–20]	8 (32) [15–54]	16 (64) [43–82]
	111	4/5	18 (16) [10–24]	39 (35) [26–54]	54 (48) [39–58]
Improve the health of infants	153	1	16 (11) [6–16]	46 (30) [23–38]	91 (60) [51–67]
	77	2	4 (5) [1–13]	23 (30) [20–41]	50 (65) [53–76]
	103	3	10 (10) [5–17]	37 (36) [27–46]	56 (55) [44–64]
	86	4	12 (14) [7–23]	28 (33) [23–44]	45 (53) [41–63]
	25	5	3 (12) [3–31]	6 (24) [9–45]	16 (64) [43–82]
	111	4/5	15 (14) [9–22]	34 (31) [26–45]	61 (54) [39–58]
Help the body function at 100% of its capacity	153	1	17 (11) [7–17]	18 (12) [7–18]	118 (77) [70–84]
	77	2	4 (5) [1–13]	10 (13) [6–23]	63 (82) [71–90]
	103	3	10 (10) [5–17]	15 (15) [8–23]	78 (76) [66–84]
	86	4	12 (14) [7–23]	15 (17) [10–27]	59 (69) [58–78]
	25	5	1 (4) [0–20]	3 (12) [3–31]	21 (84) [64–96]
	111	4/5	13 (10) [6–19]	18 (16) [10–24]	80 (72) [63–80]
Prevent degeneration of the spine	153	1	3 (2) [0–4]	14 (9) [5–15]	136 (89) [82–93]
	77	2	3 (4) [1–11]	8 (10) [5–19]	66 (86) [76–93]
	103	3	17 (17) [10–25]	15 (15) [8–23]	71 (69) [59–77]
	86	4	26 (30) [21–41]	16 (19) [11–28]	44 (51) [40–62]
	25	5	5 (20) [7–41]	3 (12) [3–31]	17 (68) [47–85]
	111	4/5	31 (28) [20–37]	19 (17) [11–25]	61 (55) [45–64]

Discussion of findings and comparison with other studies

The responses of the chiropractic students in Australia and North America [29] were similar to each other for giving advice on non-musculoskeletal health conditions. The selection of 'often' indicates a belief that their future scope of practice will extend beyond musculoskeletal conditions. This seems unreasonable, as their undergraduate training emphasises musculoskeletal medicine. Conditions

such as diabetes can be complex and challenging with serious consequences. Frequent advice at any greater depth without suitable training is ill-advised, unreasonable and outside the chiropractic students' scope of practice. On the other hand, students may believe this is appropriate, as they receive training in dietetics, exercise and possibly stress reduction that will potentially have indirect benefits on diabetes or cardiovascular disease. Future student surveys could ask for greater detail as to what is understood by the word 'advice' with respect to each condition. This would clarify if the type of 'advice' is in accord with the level of training.

This study revealed a pattern of gradually increasing numbers of students who were prepared to give advice 'often' on all the health conditions. Perhaps with increasing knowledge or exposure to patients who are seeking advice a student becomes more aware of the potential through exercise and weight loss to impact on diabetes and cardiovascular disease. This could also be due to an ill-conceived bravado, overconfidence or a lack of clinical experience. What it does suggest is a developing belief that chiropractors are sufficiently educated to be able to provide clinically beneficial information outside the scope of musculoskeletal practice, a finding also similar to North American chiropractic students [30].

Another explanation has recently been suggested. Some forms of manual therapy (e.g., osteopathic treatment) have been shown to be associated with a professional identity based on a perception that its principles are unique, complex, and distinct [11]. This 'philosophy' is, by its proponents, deemed superior to science and appears to act as a cognitive lens through which practitioners and students view, judge and reject the results from research evidence and guidelines. This 'lens' effectively inverts the view of the traditional evidence pyramid and instead augments and elevates the value of personal experiences, anecdotes and the teachings of 'expert' therapists, whilst simultaneously diminishing and obscuring results from systematic reviews and meta-analyses. In our experience, this is often the case also in the chiropractic profession.

There was a suggestion that education might have some impact with the finding that 4th and 5th final year students' proportions were lower for those who thought CSA could prevent or help with the various health conditions we had proposed, when compared to those proportions of the students from years 1, 2 and 3. However, these reductions were modest and over half of the students nearing graduation still thought that CSA could prevent degeneration of the spine and chronic back pain. Even more disconcerting was that nearly 1 in 5 of the 5th year students still thought CSA was preventative of disease in general.

Nevertheless, it was encouraging that the responses of the 5th year students in our study went against the pattern of gradually increasing numbers of students in each year of students being prepared to provide advice 'often' on cardiovascular disease and diabetes. In fact, numbers were gradually decreasing in sequential years for the number of students, who were adopting non-evidence-based beliefs for CSA, until 5th year when the numbers increased, reversing this pattern. This finding stands at odds with a curriculum which is intended to prepare them to be lifelong learners, and hence capable of delivering evidence-informed care. Implicit in our comments is the assumption that the curriculum is consistent across the years and does not change over time. On the other hand, one could hope that this result may be an artefact due to the small sample size in the fifth year. Nevertheless, it should not be disregarded, as it could be important information that provides researchers and educators with an educational time point that requires careful further investigation for contributing educational or environmental factors, such as the internship / clinical educational component.

Previous research with medical students has suggested that the transition from studentship to internship is often marked by a subjective sense of power [31]. Consequently, students become overconfident, which in turn has been associated with diagnostic errors and the selection of interventions that do not have an evidence base [32]. This may also be the case for chiropractic students, when they begin their clinical training and could account for the reversal patterns noted in the 5th year student responses in our study. Studies among medical practitioners, psychologists and nurses conflict as to whether accuracy improves with training, experience, reflection or feedback [32–34]. It is an interesting finding with considerable implications for chiropractic clinical educators and warrants further investigation.

In sum, it would appear that unsupported beliefs on the chiropractic scope of practice reduce to a modest degree over the course of chiropractic education but remain prevalent and resilient.

These findings are partly disconcerting and challenge the assumption that increasing knowledge extinguishes the likelihood of these non-evidence based beliefs. It raises several questions. How can chiropractic students express acceptable attitudes to guideline adherence and attitudes to functioning individuals with LBP [35], yet hold such unrealistic health beliefs? Is it possible that such discordant beliefs could be held also by other health care providers such as, medical practitioners, nurses or physiotherapists? Or is it only present in those with a strong professional identity underpinned with a "philosophy"? Are these irrational beliefs benign with no negative impact on guidelines based-care? Do they change with entry into the workforce? These are areas to be explored in the future and should include practicing chiropractors as well.

Methodological considerations

Our two sets of questions were developed specifically to meet our needs and were pre-tested and refined. As they were fairly simple, we do not expect that students found them difficult to answer. There were almost no missing answers, which further strengthened our assumption that the questionnaire was user-friendly.

The response rate was relatively good for one chiropractic program but not so good for the other. Since the study was anonymous, we could not compare responders to non-responders. However, the profiles in relation to other factors were similar in the two programs and have been reported elsewhere [12]. We therefore assumed that the two student samples were similar. We combined the 4th and 5th year students to create a larger group because of the small number of 5th year student responders. However, as the result profiles were different in these two groups, we also separated them to report their data independently.

The questions asked for the 'out of scope' advice and health conditions were broad in nature. For example we could have asked "would you give advice to patients on their appropriate dosage of insulin" rather than "will you give advice on diabetes" or "does CSA prevent lung cancer". As this paper was exploratory in nature we chose to begin with 5 common 'big picture' domains to gain an initial impression of student beliefs. A greater understanding of advice giving / 'out of scope practice' and unorthodox beliefs will be gained by more detailed questions in each of the domains.

Finally, the cross-sectional nature of this study limits any causal inferences that can be made about an individual's knowledge progression over the course of chiropractic education. Hence, it would be relevant to follow the same cohort over its educational progression through the course. Intention to do something may not translate into reality, so it would also be relevant to follow them into practice to see if these intended advice patterns materialised.

Conclusion

Evidence-based beliefs relating to musculoskeletal conditions are common in Australian chiropractic students but, at the same time, non-evidence-based beliefs are fairly common as well and are not dissimilar to those of chiropractic students in the North America. Australian students may not understand the limitations that education attempts to place on their scope of practice. Further, non-evidence-based beliefs appear to reduce somewhat but essentially remain resilient to change over the 5 years of their education. These findings suggest further research and a re-think on how chiropractic educators go about their business to produce graduates who understand and deliver evidence-based health care and are capable of integrating into the mainstream health care system.

Additional file

Additional file 1: Anonymous Questionnaire for Chiropractic Students Survey. (DOCX 23 kb)

Abbreviations

CSA: chiropractic spinal adjustments; LBP: Low back pain; MQ: Macquarie University; MSK: Musculoskeletal; MU: Murdoch University; NP: Neck pain

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Authors' contributions

SI and CLY were responsible for the study design. SI and CLY undertook the data analysis and interpretation. SI and CLY developed the initial and iterative draft. BW and CLY were responsible for reviewing and redrafting the final manuscript. All contributed to the final version. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Ethics approval was granted by Murdoch University Human Research Ethics Committee (Project No 2016/118).

Consent for publication

Not applicable.

Competing interests

Bruce Walker is Editor-in-Chief and Charlotte Leboeuf-Yde is Senior Editorial Adviser of the journal *Chiropractic & Manual Therapies*. Neither played any part in the assignment of this manuscript to Associate Editors or peer reviewers and are separated and blinded from the editorial system from submission inception to decision. Bruce Walker is Head of the Council on Chiropractic Education Australasia (CCE-Australasia) accredited chiropractic program at Murdoch University in Perth, Western Australia, and a Board member of the CCEA.

Publisher's Note

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CHAPTER 6: Practitioner profile & clinical decisions.

Attribution

Chapter Six of this thesis is published as the following study

- Innes, S., Leboeuf-Yde C., & Walker B.F., Attempting to explore chiropractors and their clinical choices; An examination of a failed study. Chiropractic & Manual Therapies. 2019. 27:15. Doi.org/10.1186/s12998-019-0236-0.

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Stanley Innes co-designed the methods and analyses with the co-authors, analysed the data and contributed to its interpretation, drafted the manuscript, and submitted the manuscript. All authors critically reviewed and approved the final version.

Summary and link to next chapter

Chapter Six expanded the thesis investigations to practicing chiropractors to explore Objective Five. Namely, that there is a relationship of unsuitable chiropractic practice profiles and clinical decision making with various intrinsic and extrinsic factors.

Unfortunately, this study was made untenable by a poor response rate. Several possible explanations are proffered for the non-response in Chapter Six.

When combined with the failed site inspection study, it becomes obvious that there are issues within the practice and education of chiropractic that are met with resistance. There are issues that are considered 'sensitive', and this results in practitioners and CCEs avoiding discussion or scrutiny about them. It is speculated that this may be because of the potential for adverse findings.

It was decided that on the basis of this failed study, and that of the study attempting to explore how CCEs undertake site inspection of CPs, that another approach was required to gain insights into these issues.

To this end we undertook a substantial qualitative study, seeking to interview people who had extensive experience within CCEs about their lived experiences in matters of accreditation standards and processes. We also enquired about what their views were on the findings of the studies in the earlier chapters of this thesis. This constituted Chapter Seven.

Study: Attempting to explore chiropractors and their clinical choices; An examination of a failed study.

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RESEARCH Open Access

Attempting to explore chiropractors and their clinical choices: an examination of a failed study

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Abstract

Background: Recent studies have shown that psychological factors, attitudes and beliefs impact on the quality of chiropractic student clinical decisions. This association has not been studied among qualified chiropractors. Our objective was to investigate if personality, psychological factors and/or unorthodox beliefs among chiropractors are related to choices of management in specific clinical scenarios.

Method: In February 2018, a subsample of chiropractors ($N = 700$) from a practitioner-based research network in Australia known as ACORN ($N = 1680$), were invited to respond to an on-line anonymous questionnaire. Questions included items relating to management of specific clinical scenarios, intolerance of uncertainty (IU) and the 'Big-5' personality score, adoption of a prescriptive technique system, self-rating of chiropractic abilities, and the level of importance of subluxation and chiropractic philosophy in the delivery of care. Descriptive analysis was to be reported and associations examined between i) personality and psychology factors, unorthodox beliefs and ii) scores obtained for management of specific clinical scenarios, numbers of interdisciplinary referrals, and guideline-based X-ray use.

Results: The number of respondents was 141 (20%) and 33 of their responses were largely incomplete resulting in a final response rate of 108 (15.4%). In addition, some questions were left unanswered. These related mainly to IU and Big-5 personality measurements. Some sample characteristics (age, number of patients per week, hours worked per week) were similar to the larger ACORN project sample. However, the low response rate indicated that the final study sample was unlikely to be truly representative of the study population and the low number of participants made association testing unsuitable.

Conclusion and recommendations: The low response rate and small study sample in this study made any substantive analysis inappropriate. For these reasons, the study was not concluded. However, the potential reasons for the low response from this large database of volunteer research participants are of interest and need to be investigated. Clearly, it is necessary to engage this population better to explore sensitive issues such as personality inventories and different practice profiles in the interest of effective health care delivery and patient safety.

Keywords: Chiropractic, Clinical decisions, Big 5 personality, Intolerance of uncertainty, Subluxation, Philosophy

Background

The recognition of the adverse impact that persistent lower back pain (LBP) places on society has been evoked so often that it would appear to be verging on a cliché. The metrics on the extent of this large problem have been regularly and recently detailed [1]. Thus it is generally accepted that LBP is the leading cause of disability worldwide, and it is estimated to affect 540 million people at any one time [1]. This has culminated in a call for action to try to halt the increasing burden it imposes on the healthcare system [2]. As part of this call, a review of the current state of the prevention and treatment of LBP called for [3], among other strategies, the cessation of low value care and clear pathways for referral for the delivery of the correct treatment at the right time and the integration of traditional healers into the health-care system. Some chiropractors have sought to position themselves as spinal care specialists [4] and the foundational basis of this is that chiropractors should be making clinical decisions that result in the delivery of efficient high value care.

Factors that impact on chiropractic decision making

Clinician decisions among first contact health practitioners have been described as being sometimes difficult to comprehend, because they do not always appear to follow logical pathways of reasoning [5–7]. Poor chiropractic clinical decisions have been identified as consequences of belief systems [8]. Some chiropractors align themselves with a vitalist philosophy, described by some as 'unorthodox' [9], and perceive that the 'subluxation' is a cause of disease that can be remedied with a spinal manipulation or 'adjustment' [9]. This group has demonstrated a predilection for non-guideline use of X-rays, non-evidence based treatment choices, and a lower likelihood of engaging in inter-professional collaboration [9].

Clinical decision-making has recently been studied in chiropractic students [10, 11]. These students appear to struggle recognising non-indicated care [11] (Goncalves et al., in press) and this difficulty was also extremely strongly associated with unorthodox beliefs (Goncalves et al., in press).

One of these studies of chiropractic students has shown a relationship between decision making and psychological factors such as intolerance of uncertainty (IU) [10]. IU refers to a dispositional characteristic that reflects a set of negative beliefs about uncertainty and represents an underlying fear of the unknown [12, 13]. These negative beliefs result in a desire for predictability [14, 15] and are associated with lower levels of confidence with decision-making [13, 16]. For medical practitioners, IU has been shown to be associated with a range of less than desirable outcomes such as lower compliance with evidence-based guidelines, [17] and generally increased resource use in the health care system [18]. The role of IU has not been explored in practising chiropractors' clinical decisions.

This recent study exploring IU in chiropractic students found that the vast majority of students had the desire to learn a prescriptive system that would indicate 'where the problem is' and 'how to treat it', rather than accepting the grey shades of clinical reality [10]. However, unexpectedly, IU was not found to be a significant predictor of this desire and this was thought to be due to a lack of clinical experience or that the IU failed to capture a relevant psychological profile. The authors of that study suggested that further research with practicing chiropractors adding broader psychological measures and questions with respect to technique adoption might bring more information. The "Big 5" psychological traits / dimensions, also known as the Five Factor Model, is a widely accepted and commonly used model of personality [19, 20] and, as such, may be an appropriate broader measure of personality to further study this unexpected result.

While practitioner uncertainty and anxiety may impact negatively on clinical decisions [21, 22] over self-confidence has been shown to be equally detrimental in medical students and physicians [23]. This also has not been studied in chiropractors.

Thus, we wanted to understand better how the psychological profiles of chiropractors might impact on their health care decisions. To this end, and based on previous research findings, we proposed four different frameworks of conceptualizing how a chiropractor may be influenced, when making clinical decisions by examining:

a) Intolerance of Uncertainty (IU)
b) Unorthodox / Vitalist belief systems
c) Self-rating / Overconfidence
d) The "Big 5" psychological profiles of agreeableness, conscientiousness, extroversion, negative emotions, and openness to experience.

Our objectives were to determine if categorising chiropractors according to these frameworks would reveal differing responses on the following aspects of health care decisions:

1. Selecting appropriate care (Indicated / Non-indicated / Contra-indicated care case scenarios)
2. X-ray usage (number of new patients X-rayed)
3. Inter-disciplinary collaboration (percentages of Formal / Informal Medical Practitioner referrals made in the past week)
4. Demographic variables (patient numbers, number of hours worked, years in practice)
5. Adoption of a prescriptive 'technique system' for determining how to 'locate' and treat back pain

6. X-ray utilisation for determining how to locate and treat back pain i.e. non-guideline-based usage.

Methods

Procedure

In March 2018 our questionnaire was distributed via an e-mail invitation to 700 chiropractors who were members of the Australian Chiropractic Research Network (ACORN) practitioner cohort [24]. This was a quantitative cross-sectional descriptive study using an anonymous on-line survey platform (Survey Monkey).

Before distribution, the survey was first pilot tested on a small number of practitioners and academic staff for errors and to measure the time taken for completion. This resulted in some minor sentence structure changes. The initial invitation e-mail contained details of the study, the involved researchers' names as well as information that the likely completion time was 25 to 30 min. A follow-up reminder e-mail was sent 4 weeks after the initial distribution. This was the maximum number of reminders allowed by ACORN.

The ACORN consists of a practitioner cohort of 1680 chiropractors, which represented approximately 36% of the licensed chiropractors in Australia, who were recruited from a national survey of all chiropractors in 2015. These chiropractors have since been approached in several surveys (but not all yet published) and to not fatigue the ACORN participants, questionnaires are sent out only to a randomly selected proportion of the cohort for each study.

Human Research Ethics approval was granted by Murdoch University (Project No 2017/157).

The questionnaire (see Additional file 1)

Information on the demographic details of the participants and their clinics was sought (sex, age, years of practice, number of patients, and X-ray usage).

Two basic cases with several potential scenarios were presented (Additional file 1) seeking chiropractors' clinical decisions in relation to a patient with neck pain and another with low back pain. The neck and low back pain (LBP) questionnaires have been previously used to assess chiropractors' clinical decision-making profiles [25–28].

Neck pain

A neck pain case study with five scenarios, beginning with a simple uncomplicated case of neck pain and progressing through to a scenario requiring immediate medical referral was presented [26]. The case study was designed so that it could be used to differentiate between chiropractors who select appropriate / inappropriate and indicated / non-indicated or contra-indicated intervention strategies and has been described elsewhere [11, 26].

In brief, we replicated a previous study where scenarios 1 and 2 of the case study were designated as the 'indicated' or 'correct' choice [11]. These patient scenarios described simple uncomplicated neck pain and the 'appropriate' or 'indicated' choice was to treat, for both.

In addition, we selected scenario 5 as an example of a 'contraindicated' case. In this scenario the patient with neck pain had been resistant to treatment and there was clear evidence of progressive neurological deterioration. Selection of any option other than the referral choice was deemed to be 'inappropriate' because 'contraindicated' (the explanation and validation is seen in Additional file 1).

Low back

The second case described a range of clinical scenarios for a patient with low back pain designed to find out which management strategies chiropractors would prefer to use [25] (Additional file 1). This questionnaire had nine possible short term outcomes that were briefly described. Six clinical management alternatives were offered for each outcome scenario, going from treatment, external opinion and/or assistance, to referral out. The details for the design of this case study, validation and subsequent research are provided elsewhere [11, 25, 27, 28].

We selected three scenarios (1, 4, 8 and 9) for this study (Additional file 1).

Scenario 1 describes a first episode of uncomplicated LBP with rapid and complete resolution and, therefore, on-going care was regarded as 'non-indicated', with the correct decision being patient discharge. In scenario 9, the patient is non-responsive to treatment and is displaying signs of depression. Any continued treatment was regarded as 'non-indicated,' i.e. of no avail but not potentially damaging.

Scenario 4 describes a patient with LBP who improves with treatment with a history of some previous uncomplicated episodes of acute LBP where each prior bout had completely resolved. The 'indicated' correct choice is some form of 'maintenance care'.

The patient in Scenario 8 is resistant to treatment and is getting worse. A second opinion is required and continued care would be 'contra-indicated'.

Psychological measurements

Intolerance of uncertainty scale (IUS-12) To study the intolerance of uncertainty, we used the validated 12-question version (IUS-12) that utilises a 5-point Likert scale with responses ranging from 'not at all characteristic of me' to 'entirely characteristic of me' [12, 29–32]. Examples of questions are 'unforeseen events upset me greatly' and 'the smallest doubt can stop me from acting'. The maximum possible score is 60, reflecting high levels of intolerance of uncertainty.

- The number of informal and formal referrals made in the last full working week: Again we intended to create 2 groups (High, Low) on the basis of dichotomising the group on a 50% split, using the median score.
- Identification with need for technique system: Participants would be dichotomised into those who used a chiropractic technique system to guide clinical care ("Yes, as best I can" and "Parts of it") and those who did not ("Not at all" and "the technique but not the system").
- Reasons for taking X-rays: Respondents were to be dichotomised into those who ordered X-rays for a specified clinical reason and those who did not.

Analysis

Data were to be summarised using descriptive statistics and reported as means, standards deviations or medians and IQRs, depending on normality for continuous data and frequency distributions for categorical data. Data would thereafter be transformed according to the previous descriptions.

Univariate group comparisons were to be made using chi-squared or Fisher Exact tests, as appropriate, for categorical data and t-test/ANOVA/Mann-Whitney U tests for continuous data. Factors associated with *IU-12, Subluxation and Philosophy beliefs, Self-rating and Big 5* binary outcomes would be explored using bivariate and multivariate logistic regression, with results expressed as odds ratios and their 95% confidence intervals.

Data were to be analysed using SPSS v.24 (IBM Corp, Armonk NY, USA).

Results

Descriptive information

Of the 700 contacted chiropractors, 141 responded to the on-line survey (20% response). The average time taken to complete the survey was 23 min.

However, there were 33 incomplete sets of data that resulted in a final 108 complete responses (15.4% response rate) of which 66% were males with a mean age of 44.3 (SD 11) years (Table 1). The 33 incomplete questionnaires all lacked the responses for practice characteristics, and the measures of IU and Big-5. Of these 33, only 4 responded to the neck and LBP scenarios although they all responded to questions on chiropractic philosophy, subluxation, and technique use.

This low response rate indicates that the study sample is unlikely to be representative of its study population. Nevertheless, the profile of the responders is presented in Tables 1 and 2 and summarized below.

The chiropractors in this study worked on average 27 h (SD 10.3) per week. They treated 91 (SD 58.7) patients per week and had been in practice for 17.9 (SD 10.4) years. These responses approximated those of the larger ACORN project participants whose characteristics are also shown in Table 1.

Table 1 Demographic and practice variables of chiropractors from this study compared to the total ACORN chiropractor population [24]

Demographic Variable	Current Study	ACORN Cohort
Age: Mean (SD)	44.3 (11) Range 25–70	41.9 (12)
Male / Female:	66.1%	62.9%
Years in practice: Mean (SD)	17.9 (10.4) Range 2–44	15.6 (11.2)
Hours / Week Work: Mean (SD)	27.1 (10.3) Range 5–60	27.3 (12.8)
Patients / Week: Mean (SD)	91 (58.7) Range 8–310	87.5 (56.3)

Descriptive characteristics of clinical groups and subgroups

Almost 70% of the participants in this study regarded chiropractic philosophy as important or very important for what they do in practice (see Table 2). Half of the subjects rated subluxation as very important or important in guiding what they do in practice. Almost 75% of the chiropractors rated their professional level as a bit above average or above average.

Associations between predictor and outcome variables

There were too few responders to make association testing appropriate.

Discussion

Summary of findings

This appears to be the first attempted study seeking to investigate chiropractors' clinical reasoning. It sought to progress findings from previous studies in chiropractic student populations by proffering four different 'psychological' conceptual and belief frameworks that might influence clinical decisions that were, in turn, to be linked with a number of different aspects of chiropractic practice used as indicators of the quality of health care delivered.

However, only 141 chiropractors participated in this study and of these only 108 provided complete data; the final response rate therefore being only 15.4%. Although there were similarities with the larger ACORN population, this low response rate means it was not possible to generalize the findings of this study to the ACORN population and certainly not to the entire chiropractic population of Australia. The low number of responders made it unsuitable to perform tests of association.

Big five Inventory-2 (BFI-2) The Big Five Inventory-2 is a 60 item inventory designed and validated to measure the five personality dimensions of agreeableness, conscientiousness, extroversion, negative emotionality and open-mindedness [33]. Responses utilise a 5-point Likert scale and range from 'disagree strongly' to 'agree strongly'.

Other measurements

Adoption of chiropractic technique system of analysis Nine chiropractic technique systems were listed (See Additional file 1). These were selected because thought by the authors to be the most commonly used technique systems, which offer a method of identifying and correcting spinal dysfunctions. Participants were asked to select the degree to which they would use each techniques system's method for analysing and / or guiding patient care. Responses ranged from 'yes, as best I can', 'parts of it' to 'not at all'.

Unorthodox beliefs Practitioners were asked to rate the importance of chiropractic philosophy and subluxation theory by asking the question: "How important is subluxation / chiropractic philosophy in what you do in practice?" We used a 5 point scale where possible responses ranged between 'not at all important' to 'very important'.

Purpose of X-ray Participants were also asked to indicate "yes" or "no" to a list of eight possible reasons why they might order X-rays. The options were: assessing for trauma, red flags, osteoporosis, osteoarthritis, spinal curves, contra-indications to chiropractic care, identifying subluxations, and assessing for patient progress.

Number of formal and informal referrals to a medical physician or specialist Practitioners were asked to state what percentage of patients over the past week they would have formally (written letter or phone call) and informally (instructed the patient verbally) referred to a medical physician or medical specialist.

Self-rating Finally, participants were asked to compare themselves as a chiropractor to other chiropractors in Australia.

Variables of interest

Potential predictor variables

IU12 Receiver operating characteristic curves (ROC) were to be determined to find cut-off points in order to create high and low IU groups from the raw IU scores [34, 35]. This was to be calculated in order to evaluate potential high IUS-12 from the total IUS-12 score. Sensitivity and specificity of the coordinate points of the resulting ROC curve were then to be used to identify the potential cut-off score for IUS-12. This decision was also to be supported by previous published research with non-clinical samples that used similar values [34, 35].

Subluxation belief The questions on subluxation belief was to be dichotomised with one group consisting of those who responded that subluxation theory was "important" or "very important" in guiding what they do in practice into one group vs. a group consisting of all the remaining responses (I have no opinion, neutral, only somewhat important, not at all important).

Chiropractic philosophy belief In the same manner, chiropractors who responded that chiropractic philosophy was "important" or "very important" in what they do in practice would be compared with those who selected any other option.

Self-rating as a chiropractor compared to other chiropractors Participants were asked to rate their professional level as a chiropractor in comparison to other chiropractors in Australia. Six options were possible ranging from "below average" to "above average". This group would be dichotomised into those who selected "A bit above average" / "above average" and those who selected "average", "I don't know", "a bit below average" or "below average".

Big-five factors (BFI-2) The "Big Five" raw scores were to be recoded into the 5 domains of agreeableness, conscientiousness, extroversion, negative emotions and openness to experience using the SPSS syntax provided by the authors of the BFI-2 in order to create 5 continuous measures [33].

Outcome variables and their rationale

From this survey, variables shown to be associated with undesirable chiropractic practice characteristics were selected from previous research (as described above), in addition to the demographic and practice data:

- Indicated / non-indicated / contra-indicated care: Seven dependent variables were selected, three from the neck pain and four from the low back pain questionnaires. Of these two were *contra-indicated* cases, two *non-indicated* cases and three *indicated* cases. The 'appropriate' answers proposed in the previous study on this topic for the low back and neck questions were used [36]. The rationale is presented in Additional file 1.
- X-ray usage: The number of X-rays requested for the last 10 new patients would be split into 2 groups using the median score. This would potentially result in a 'low' and 'high' group for ordering X-rays.

- The number of informal and formal referrals made in the last full working week: Again we intended to create 2 groups (High, Low) on the basis of dichotomising the group on a 50% split, using the median score.
- Identification with need for technique system: Participants would be dichotomised into those who used a chiropractic technique system to guide clinical care ("Yes, as best I can" and "Parts of it") and those who did not ("Not at all" and "the technique but not the system").
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Male / Female:	66.1%	62.9%
Years in practice: Mean (SD)	17.9 (10.4) Range 2–44	15.6 (11.2)
Hours / Week Work: Mean (SD)	27.1 (10.3) Range 5–60	27.3 (12.8)
Patients / Week: Mean (SD)	91 (58.7) Range 8–310	87.5 (56.3)

Descriptive characteristics of clinical groups and subgroups

Almost 70% of the participants in this study regarded chiropractic philosophy as important or very important for what they do in practice (see Table 2). Half of the subjects rated subluxation as very important or important in guiding what they do in practice. Almost 75% of the chiropractors rated their professional level as a bit above average or above average.

Associations between predictor and outcome variables

There were too few responders to make association testing appropriate.

Discussion

Summary of findings

This appears to be the first attempted study seeking to investigate chiropractors' clinical reasoning. It sought to progress findings from previous studies in chiropractic student populations by proffering four different 'psychological' conceptual and belief frameworks that might influence clinical decisions that were, in turn, to be linked with a number of different aspects of chiropractic practice used as indicators of the quality of health care delivered.

However, only 141 chiropractors participated in this study and of these only 108 provided complete data; the final response rate therefore being only 15.4%. Although there were similarities with the larger ACORN population, this low response rate means it was not possible to generalize the findings of this study to the ACORN population and certainly not to the entire chiropractic population of Australia. The low number of responders made it unsuitable to perform tests of association.

Table 2 Construction of variable groups and their characteristics

Domains	Variable	Variable construction	Number (%)
Patients / week	Mean 91.4 (58.7)	Low	27 (26)
Missing 39	Median 82.5 / week	Average	49 (45)
	Range 7–310	High	26 (28)
X-rays (High and Low)	New Patient X-rays,		
Missing 33	Mean 3.6 (2.7)	Low	52 (48)
	Median 3,	high	41 (52)
	Range 0–10		
Reason X-rays	Contraindications	Yes	79 (73)
	Missing 39	No	29 (27)
	Osteoarthritis	Yes	70 (66)
	Missing 35	No	36 (43)
	Osteoporosis/paenia	Yes	63 (61)
	Missing 38	No	40 (39)
	Patient progress	Yes	5 (4)
	Missing 2	No	135 (96)
	Red Flags	Yes	98 (91)
	Missing 39	No	10 (9)
	Scoliosis	Yes	66 (61)
	Missing 33	No	42 (39)
	Subluxation	Yes	15 (11)
	Missing 1	No	125 (89)
	Trauma	Yes	99 (91)
	Missing 32	No	10 (9)
Referral			
Informal	Mean 4.9 (4.9)	No Referrals	50 (52)
(*N* = 108)	Median 4,	At least one	45 (48)
Missing 33	Range 0–40		
Formal	Mean 2.3 (2.7)	No Referrals	9 (8)
(*N* = 108)	Median 2,	At least one	99 (91)
Missing 33	Range 0–20		
Technique	Advanced Bio-structural	Yes & parts of it	7 (7)
	Correction	No to all else	89 (93)
	Missing 45		
	Activator	Yes & parts of it	32 (26)
	Missing 17	No to all else	92 (74)
	Applied Kinesiology	Yes & parts of it	42 (43)
	Missing 19	No to all else	80 (66)
	Chiropractic BioPhysics	Yes & parts of it	12 (11)
	Missing 36	No to all else	93 (89)
	Functional Neurology	Yes & parts of it	58 (51)
	Missing 27	No to all else	56 (40)
	Gonstead	Yes & parts of it	45 (40)
	Missing 27	No all else	69 (60)
	Neural Organisation Technique	Yes & parts of it	7(7)

Table 2 Construction of variable groups and their characteristics *(Continued)*

Domains	Variable	Variable construction	Number (%)
	Missing 38	No to all else	96 (93)
	Sacro Occipital Technique	Yes & parts of it	58 (49)
	Missing 23	No to all else	60 (51)
	Thompson	Yes & parts of it	66 (54)
	Missing 30	No to all else	55 (46)
Chiropractic Philosophy	*Missing 8*	Very / Important	90 (68)
		All others	43 (32)
Subluxation	*Missing 1*	Very / Important	75 (53)
		All others	65 (47)
Self-rating	*Missing 37*	I don't know / Av	29 (38)
		Above Av	75 (72)

Explanation of findings

There is limited literature to guide researchers in the practical aspects of recruiting professionals for research studies. The magnitude of this problem has previously been demonstrated with a review of the National Institute for Health inventory of trials showing that only 34% of trials ever reached their projected sample size [37].

Nevertheless, previous studies of chiropractors in other countries have resulted in better response rates. For example; Denmark 72% [38], Finland 88% [39], Norway 61% [40], Sweden 60% [25] and 77% [41]. These studies were all conducted in Scandinavia. The low response rate in the present study could therefore be a cohort problem, particular to Australia, as only 43% of all registered chiropractors originally consented to become members of the ACORN 'panel'. Of these 2005 practitioners, only 83% (1680) did thereafter agree to join. Despite this acceptance, the one other published study from this 'panel' reported a response rate of only 33% [42].

Even so, the response rate in our study is discordant with that previous ACORN study. There would therefore appear to be something that triggered a general non-response. The pilot testing did not identify any obstacles that can explain this low response rate.

A potential explanation for the difference in the willingness to participate in surveys could be that the Scandinavian studies might have been considered clinically 'helpful' as they related to clinical questions such as predictors of outcome and defining maintenance care. It is possible that the previous and present Australian studies were felt to be uninteresting and less meaningful. The additional level of disinterest in the present study could also have been in protest, if chiropractors felt the topic to be politically 'dangerous', dealing with practice behaviour, and perhaps too personal regarding personality traits.

Other explanations for potential participants choosing not to respond to such a degree that the study has 'failed' could include a lack of belief that a relationship existed between the variables being researched [43], an uncomfortableness with being seen as unable to manage the technical aspects of the study [44], the likely benefit of the study was not worth the time taken to respond [45], or that the research question was not 'worthwhile' [46]. It is not possible to definitively know which one, or which combination of these explanations – if any - impacted on this study.

Another significant impediment to response is likely to be the inability to remind chiropractors to respond. Best practice for enhancing response rates in surveys is to initially send a "herald" notice that the survey is coming and important, then a despatch of the survey and at least two follow-up reminders at spaced intervals [47]. Unfortunately, ACORN will not allow this type of reminder system and this could impair response rates in future surveys of ACORN participants.

Examination of the 33 incomplete response sets identified that absence of replies to the intolerance of uncertainty questionnaire (12 items) and the Big-5 inventory (60 items) was common to all of these partial responders. It is possible that non-responders failed to participate for the same or similar reason, namely, that this study gives the appearance of practice behaviour being associated with psychopathology or deviant behaviour patterns. As such, it could be negatively perceived as an 'attack' on the chiropractic profession. The offer of anonymity on the patient information recruitment email does not appear to have alleviated concerns.

Studies exploring psychological profiles and belief systems have been conducted in other health professions and have provided valuable insight into factors that impact on clinical decision making and have the potential to improve health economics and patient safety [17, 18, 23, 48]. These factors may also be important in chiropractic care. This study suggests that this is a 'sensitive area' and that future efforts to gather data to examine such issues may be inherently problematic. It is possible that repeated similar

attempts will only result in accentuating this type of non-response behaviour and 'drive it further underground'. One possibility to improve the situation may be to conduct a qualitative study by a known and trusted interviewer(s) to identify the reasons for this reluctance to participate. This method may also seek information from interviewees on ways to engage this population better. Once the drivers for this type of behaviour are identified it may be possible to better articulate the aims, wording and design of the study to potential participants and thus improve response rates. Past research has shown, with appropriate funding, the better known methods are monetary (preferably prepaid) and non-monetary incentives (lotteries, gifts) [49], SMS reminders [50], and personal contact to achieve this end [51]. Future studies may also benefit from adding locally known and trusted network leaders to the target population [52]. In addition, ACORN should review its restrictions on reminders to enhance response rates.

Conclusions

This study was made untenable by a poor response making it impossible generalize any findings and to conduct any association testing. There are many possible explanations for this non-response. A way to engage this population to explore these poor practice profiles in the interest of effective health care delivery and patient safety is required.

Additional file

Additional file 1: Survey Questionnaire and Rational for scoring of neck and LBP scenarios. The additional file contains the survey distributed to all of the ACORN practitioners. It also contains the rational for the scoring of the neck and LBP case scenarios as Contraindicated, Indicated and Non-Indicated. (DOCX 366 kb)

Abbreviations

ACORN: Australian Chiropractic Research Network; B.F.I-2: Big Five Inventory version 2; IU: Intolerance of uncertainty; S.D.: Standard Deviation

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Authors' contributions

SI, BW and CLY were responsible for the study design. SI and CLY undertook the data analysis and interpretation. SI developed the initial and iterative draft. BW and CLY were responsible for reviewing and redrafting the final manuscript. All contributed to the final version. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Ethics approval was granted from Murdoch University Human Research and Ethics Committee (Project No 2017/157).

Consent for publication

Not applicable.

Competing interests

Bruce Walker (BFW) is Editor-in-Chief and Charlotte Leboeuf-Yde (CLY) is Senior Editorial Adviser of the journal *Chiropractic & Manual Therapies*. Neither played any part in the assignment of this manuscript to Associate Editors or peer reviewers and are separated and blinded from the editorial system from submission inception to decision.

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CHAPTER 7: Qualitative exploration of CCEs experts' views.

Attribution

Chapter Seven of this thesis is published as the following two studies

- Innes, S., Cope, V., Leboeuf-Yde C., & Walker B.F. A perspective on CCE accreditation standards and processes from the inside: A narrative description of expert opinion. Part 1: Themes. Chiropractic and Manual Therapies. 2019. 27, 57.

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- Innes, S., Cope, V., Leboeuf-Yde C., & Walker B.F. A perspective on CCE accreditation standards and processes from the inside: A narrative description of expert opinion. Part 2: Topics. Chiropractic and Manual Therapies. 2019. 27, 56.

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Stanley Innes co-designed the methods and analyses with the co-authors and analysed the data, with assistance from Associate Professor Vicki Cope, and contributed to its interpretation, drafted the manuscript, and submitted the manuscript. All authors critically reviewed and approved the final version.

Summary and link to next chapter

Chapter Seven is composed of a qualitative study conducted to investigate the failed attempts to investigate Objectives Three, Four and Five. In addition, this provided an opportunity to gain insights into CCE experts views on the findings in this thesis investigating accreditation standards and graduate competencies.

The interviews were rich sources of information and were structured into two studies. The first explored the themes that emerged during the responses of the CCE experts to the findings of our previous studies, while the other explored the specific responses to detailed questions.

CCE informants were discerning of the negative and positive elements in the CCE procedures as well as being cognizant of the difficulties encountered in determining the aims, objectives of the CCE standards and their execution. The reasons for the considerable variability between CPs worldwide were found to be a result of a political negotiation process by which CCEs determine their standards and efforts to allow all "understandings" of chiropractic to co-exist. This results in standards and procedures that are sufficiently non-specific to allow for both types of institutions to pass the CCE accreditation requirements. The implications of these findings are discussed and explored in Chapter Eight.

Study: A perspective on CCE accreditation standards and processes from the inside: A narrative description of expert opinion. Part 1: Themes.

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Chiropractic & Manual Therapies

RESEARCH Open Access

A perspective on Chiropractic Councils on Education accreditation standards and processes from the inside: a narrative description of expert opinion

Part 1: Themes

Stanley L Innes[1*], Vicki Cope[1], Charlotte Leboeuf-Yde[1,2] and Bruce F. Walker[1]

Abstract

Background: The aim of this study was to report on key informant opinions of Councils on Chiropractic Education (CCE) regarding recent research findings reporting on improving accreditation standards and processes for chiropractic programs (CPs).

Methods: This qualitative study employed in-depth semi-structured interviews with key experienced personnel from the five CCEs in June and July of 2018. The interviews consisted of open-ended questions on a range of issues surrounding accreditation, graduate competency standards and processes. All interviews were audio-recorded, and transcribed verbatim. The transcripts were analysed to develop codes and themes using thematic analysis techniques assisted by NVivo coding software. The study followed the COREQ guidelines for qualitative studies.

Results: Six themes were isolated from the interview transcripts; they were: professional differences; keep it in the family; to focus on outcomes or be prescriptive?; more resources please; inter-profession integration; and CPs making ends meet. Most respondents saw a need for CCEs standards and processes to improve interdisciplinarity while at the same time preserving the 'uniqueness' of chiropractic. Additionally, informants viewed CCEs as carrying out their functions with limited resources while simultaneously dealing with vocal disparate interest groups. Diverse views were observed on how CCEs should go about their business of assessing chiropractic programs for accreditation and re-accreditation.

Conclusions: An overarching confounder for positive changes in CCE accreditation standards and processes is the inability to clearly define basic and fundamental terms such as 'chiropractic' and its resultant scope of practice. This is said to be because of vocal, diverse and disparate interest groups within the chiropractic profession. Silence or nebulous definitions negotiated in order to allow a diversity of chiropractic practice to co-exist, appears to have complicated and hindered the activities of CCEs. Recommendations are made including an adoption of an evidence-based approach to accreditation standards and processes and the use of expertise from other health professions. Further, the focus of attention should be moved away from professional interests and toward that of protection of the public and the patient.

Keywords: Accreditation, Chiropractic, Competence, Qualitative

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Background

It is well known that members of the medical profession generally are wary of the chiropractic profession [1]. In our experience, many chiropractors think this is based on an unfair type of bias. Chiropractic is 'officially' presented as an evidence-based friendly health care profession, keen to be integrated with the rest of the health care community in the treatment of musculoskeletal conditions [2]. However, the practice of chiropractic is not above criticism. Varied sections of the profession, depending on the part of the world they practice in, promote the use of chiropractic manipulation for a wide range of non-musculoskeletal conditions, which is controversial and evidence of this can easily be seen by reading the self-promotion of chiropractic clinics on their websites from all over the world.

It is therefore not surprising that as the profession has become larger and more visible there have been organised reactions to such practice. For example, recently the Spanish Ministries of Health and Science have announced an intention to implement a 'Health Protection Plan against Psuedotherapies' and appears likely to include chiropractic [3]. Attempts to establish university-based education in chiropractic have been rejected in Florida, U.S.A. [4] partially due to resistance from vocal interest groups highlighting unsupported claims by chiropractors and, in Sweden, [5] because of the Universities becoming aware of inappropriate website claims. This has led to the Universities management judging the profession unsuitable to be associated with. In the United Kingdom a systematic campaign of notification to the General Chiropractic Council was undertaken by a group of activists who targeted the inappropriate use of science, to highlight many sub-standard chiropractic websites [6]. In Australia, a movement called 'Friends of Science' used chiropractic education as an example of non-evidence based alternative medicine that should be excluded from university education, in part based on the discovery of the opening of a 'paediatric clinic' treating some non-musculoskeletal illnesses at the RMIT University chiropractic school clinic in Melbourne, Australia [7–9].

There are other examples, so this leads us to the conclusion that the criticisms are thus not wholly unfounded. Importantly, these aberrant actions by some of the profession have implications for patient safety and quality of care [10–17]. According to a Canadian study, approximately 18% of the practicing chiropractors were found to have practice patterns that could be described as 'unorthodox' (*vitalist)* and demonstrated high levels of anti-vaccination attitudes, use of non-evidence based treatment choices, non-guideline use of X-rays, and low levels of inter-professional collaboration [18]. In Australia, chiropractic students were found to have non-evidence-based healthcare beliefs that were resistant to the educative process [19]. Further recent research has identified personality types that impact negatively on chiropractic students' clinical decisions [20]. Also, chiropractic students in Australia [21] and France [22] have been shown to be poor at recognising when treatment will make no difference to patient outcomes. This inability to acknowledge the limits of competencies was, in one of the studies, very strongly associated with a conservative belief in the 'powers' of the subluxation [22].

Further, 'unorthodox' or conservative/vitalistic behaviours patterns in chiropractic practice appear to be 'sensitive' issues and practitioners are reluctant to participate in studies exploring these issues. A recent study was thwarted through a very low response rate where few chiropractors responded to the 'sensitive' questions [23].

The education of chiropractors is one important nexus that should be influencing standards of chiropractic practice. The guardians of these standards are various Councils on Chiropractic Education (CCEs), one in Europe [24], one in Australia [25], one in Canada [26] and one in the United States of America [27], and an international organisation initially formed by these four CCE, the CCE-International [28]. These councils are responsible for accrediting the chiropractic courses in their 'jurisdiction' and preferably the standards they set should be homogeneous all over the world. However, there is substantive evidence that the standards they set and monitor are not homogeneous nor of an adequate standard [18, 29–32].

Chiropractic undergraduate institutions issued a declaration in 2015 that chiropractic education programs have an ethical obligation to support an evidence-based teaching and learning environment and global consistency in accreditation and assessment [33]. Thirteen [34] of the 36 chiropractic programs [35] that are accredited by a CCE signed this statement. In 2001, all the regional CCEs became signatories to the CCE-International with the intent to collaborate, assure excellence and consistent quality improvements in chiropractic education through accreditation. However, in 2015 the CCE-USA withdrew from this agreement, without public explanation by the CCE-I or the CCE-USA, and this would appear to considerably reduce the likelihood of agreement between all regions [36]. On the surface this appears to be a failing of CCEs to group together to create and monitor a homogeneous set of high quality standards in the interests of public safety, professional respectability, and workforce portability. Medical education has achieved this [37]. Why has it not happened for chiropractic?

Given there has been a reluctance by some chiropractors to engage in quantitative survey research on these 'sensitive' issues, another way needed to be found. Qualitative research is able to explore complex phenomena

obtaining an in-depth understanding by seeking the respondents viewpoints on the phenomena of interest [38]. Consequently, we sought to ask people with extensive experience in CCEs, their views on significant matters, in order to provide insights into these questions and concerns from the perspective of those experiencing it. Opinions from experts has proven to be valuable for developing policy [39, 40] and improving educational curricula [41]. To this end, we conducted interviews of experts with first-hand knowledge of the five CCEs.

Aim

The primary aim of this study was to explore the experience and beliefs of CCE experts on accreditation standards and processes of chiropractic programs (CPs) by seeking their views on:

I. Competencies for graduating chiropractors. In particular the implementation of identical competencies for all CCEs.
II. Accreditation and re-accreditation standards for CPs. In particular the implementation of identical standards for all CCEs.
III. The processes and standards for site inspection teams of CPs.
IV. CCEs monitoring CPs to ensure that students learn important course material.
V. The influence of vitalism and evidence-based practice in CP course material.

This paper addresses the common themes in the responses of the participants across these five issues listed above (Part I). A subsequent paper will be developed exploring the responses to each of these issues in turn, garnering the diverse discussion and controversial professional responses found (Part II).

Method

This was a qualitative descriptive study utilising in-depth semi-structured interviews in-person via Skype and telephone. The interview questions were generated from recent research that identified a number of issues and concerns with respect to CCE accreditation standards and processes. These questions are summarised in Table 1 and the full interview (*aide de memoir*) is included in Additional file 1.

Ethics approval was obtained from the University Human Research Ethics Committee (2018/055) before recruitment and data collection. The study followed the COREQ guidelines for qualitative studies [42].

Participants

Thirteen email approaches were made to expert participants. There were 4 non-responders. One non-responder did not answer 3 e-mail approaches. Two non-responders initially agreed but then did not respond to further emails when attempting to arrange an interview time. Another initially agreed, but then expressed concern over a possible conflict of interest with a CCE, and after that did not respond to further email contacts. Finally, one responder missed the Skype interview and provided written responses to the questions. This resulted in 9 key participants (6 men and 3 women) who were interviewed. Two participants were non-chiropractors. The people who serve on the CCE-I are selected from member CCEs. The CCE-I does not have any geographical jurisdiction, nor is it involved in making any accreditation decisions. In order to address this issue, the identified respondents from the CCE-I were also required to have had extensive experience (at least 8 years) with a member agency in these matters.

Characteristics of the sample are not given to protect the anonymity of participants. The nine participants had an average of 14 years' experience working for a CCE. The interviews were conducted between May and July of 2018 and lasted between 32 and 62 min, with an average duration of 44 min.

Signed or verbal consent was obtained from all participants prior to being interviewed. All transcribed records were kept confidential, with only the investigators having

Table 1 Questions asked of CCE experts and the respective study from which it was based on

Question	Study
What are your views about implementing identical graduating chiropractor competency standards for all CCEs?	[29]
Is there anything you would like to change in the domains of competencies for graduating chiropractors?	[29]
What are your views about implementing identical accreditation standards for all CCEs?	[30, 31]
Is there anything you would like to change in the domains of CCE accreditation standards?	[31, 36]
What are your views on the ability of CCE site inspection teams to monitor and improve the quality of CPs?	[31]
What are your views on the CCEs role in CPs to ensure that students learn relevant clinical course material? For example, learning the contra-indications for chiropractic care?	[21]
What are your views on CCEs requiring CPs to teach students about understanding their own personality, attitudes or beliefs and how these may impact on their clinical decisions?	[20]
What are your views about the inclusion of vitalism and evidence based practice into CP course material?	[30, 36]

access to the information provided. Participants were de-identified by being assigned a reference number between 1 and 9.

Participant recruitment

We incorporated snowball sampling. An example of this is shown in Fig. 1. The actual contact details are not provided to protect the confidentiality of the participants. This sampling is a non-probability sampling technique used by researchers to identify potential participants for studies where respondents are hard to locate [43].

Individuals known as having had a long-standing association or had extensive experience with a CCE were contacted via email. The purpose of the study was explained to them and they were asked to identify other potential participants. Two key representatives from each of the 5 CCEs were being sought. CCE participants were expected to have been involved with a Board, Commission or as a site team member for a period of at least 8 years duration. Additionally they were required to be either currently serving, or had done so within the last 5 years and could not have been dismissed from CCE service. As this was to be a narrative description of expert opinions, past research has suggested that 1–2 individuals from each organisation (CCE) is an adequate sample size, that is, this would provide between 5 and 10 individuals in total [44] . Interviews were conducted, transcribed, coded and analysed in-turn. These were reviewed by the lead researcher and then further reviewed and discussed with a qualitative research investigator, as to whether thematic saturation had been reached. The researchers agreed that thematic saturation was reached after the ninth interview. Consequently no further participants were sought.

Data collection

Data were collected from consenting participants using a semi-structured in-depth interview process. Because the experts were located in North America, Europe, Canada, and throughout Australia or New Zealand, the interviews were to be conducted by either Skype or telephone. One-on-one interviews were held at a time convenient to each participant.

The principle researcher (SI) conducted the interviews (n = 9). The nine participants were provided with the pending questions prior to the interview and invited to reflect on them. Participants were also invited to make further comments as they felt appropriate to the topics under discussion during the interview. An *aide de memoire* was used to ensure consistency across all the interviews (Additional file 1). Participant responses were audio recorded on two digital devices and transcribed verbatim.

Data analysis

All interviews were then imported, organised into themes and analysed using the qualitative analysis NVivo 11 software. Thematic analysis of the recordings was used to analyse the data as outlined by Braun and Clarke [45]. Repeated readings results in familiarisation of the data and leads to identification of recurrent patterns and themes. Using NVivo assistance software and manual coding key, concepts were isolated, and themes and subthemes were identified.

Trustworthiness of data and interpretation of the study involved four categories: credibility, transferability, dependability and confirmability [46]. To increase credibility, the transcriptions were returned to the interviewees for verification of accuracy. This ensured verification of data. The interviewer was familiar with relevant CCE documentation and this helped ensure credible interpretation of the interactions with the participants, thus improving

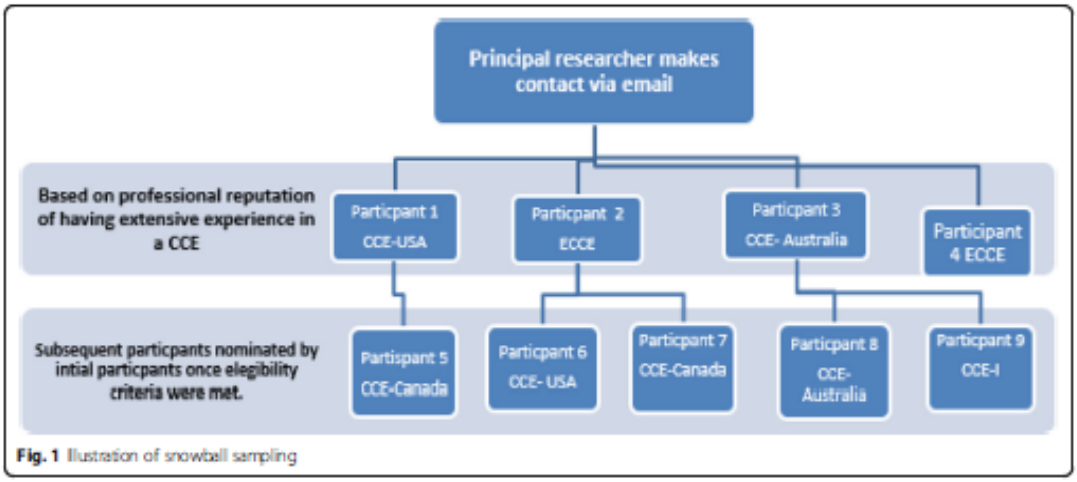

Fig. 1 Illustration of snowball sampling

methodological rigour [47]. To attain dependability and confirmability of the data, the analysis process was reviewed by another qualitative expert (VC).

Results

Findings / recurring themes

Nine participants were interviewed. There were six recurring themes raised by the majority of respondents across all questions in the interviews and were considered to be overarching. The six themes were: Professional differences; keep it in the family; to focus on outcomes or be prescriptive?; more resources please; inter-professional integration; and CPs making ends meet.

In support of these themes, word trees developed from the NVivo software are presented in Figs. 2, 3, and 4. The word trees were developed from the verbatim quotes of the participants. To illustrate these 'word trees' the responses for the themes "to focus on outcomes or be prescriptive?" and "more resources please" are diagrammatically captured as examples.

Theme 1: professional differences

The dominant recurring theme from all respondents across the questions concerned the difficulties CCEs encounter when carrying out their functions as a result of various and diverse interest groups' strongly held opinions. This was mentioned in the context of establishing accreditation and competency standards as well as when defining terms such as 'chiropractic' and 'diagnosis'. Respondents thought that these vocal interest groups had little or no expertise in matters of education but nonetheless adopted philosophical standpoints that caused conflict, and in turn, resulted in negotiated settlements on definitions and standards.

R1: "If we see improvement as moving ahead quickly then unity and uniformity has been a challenge because we - we spent a lot of time discussing issues that were either philosophical or issues that we had to do because of this ... and ...well basically we were being brought down by internal qualms and problems".

Theme 2: keep it in the family

Two thirds of respondents commented that careful decisions were required by CCEs to make sure that chiropractic continued to maintain its 'uniqueness'. Threats were believed to be non-chiropractors acting as members on CCEs or CP site inspection teams who may apply other health profession accreditation standards and processes that were not transferable to the education of chiropractors. Interestingly, one respondent thought this uniqueness (chiropractic manipulative skills) was threatened by increasing female numbers in the profession who are perceived to be less physically able, and thus less likely to use traditional manipulative skills and are more likely to adopt 'low force' techniques.

R7: "You can't just bring people - experts, educational experts from other fields, put them together and they will do a good job because they won't understand the nuances of what it is to be a Chiropractor and what it is to – what is a Chiropractic institution - what inherent problems can exist".

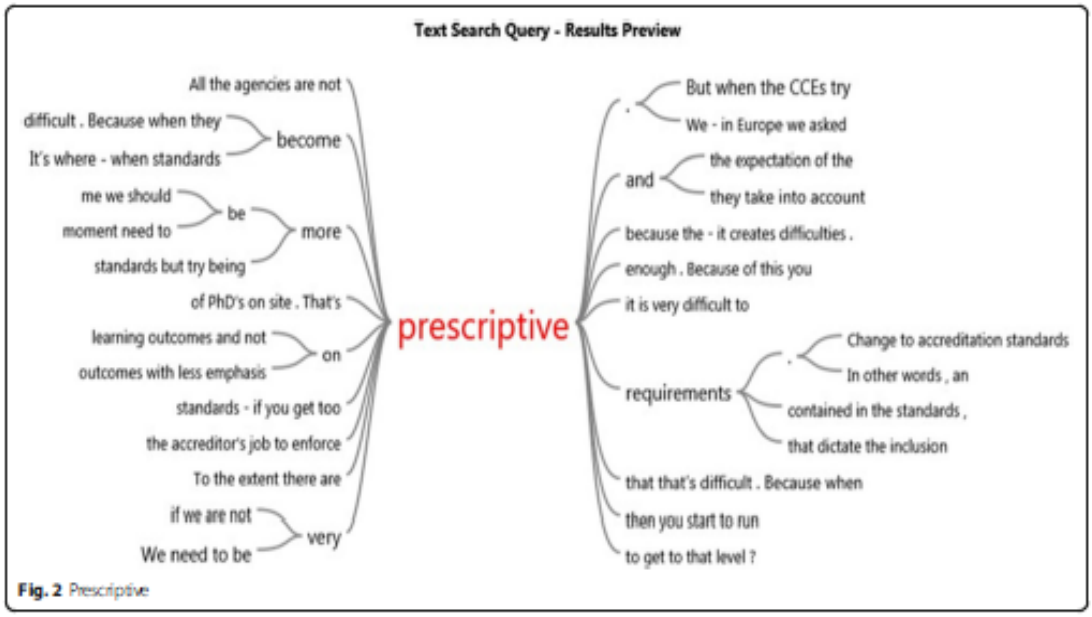

Fig. 2 Prescriptive

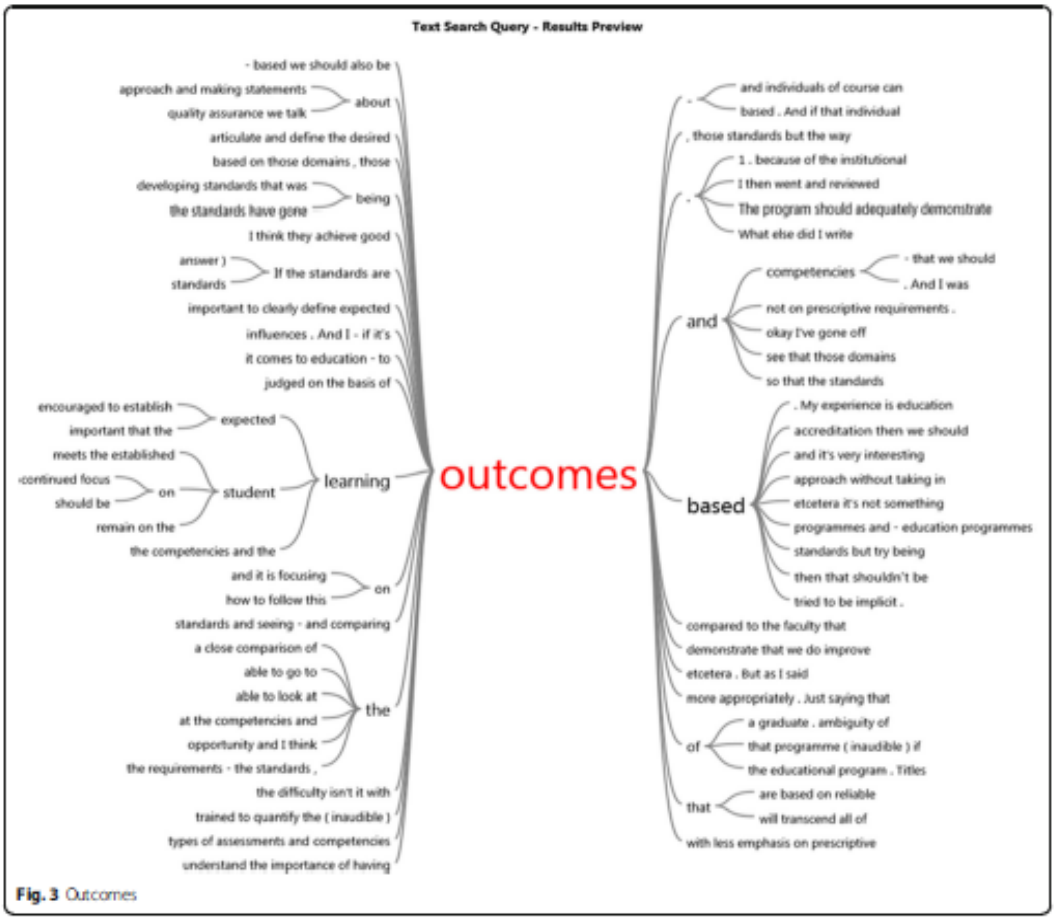

Fig. 3 Outcomes

Theme 3: to focus on outcomes or be prescriptive?

Participants expressed varied views on how best to go about their business of assessing CPs. Some participants lamented the absence of detailed descriptive and prescriptive standards. Inherent in this stance was an acute awareness that existing competencies for graduates and accreditation standards are set at a minimum level. Others saw the way forward as focusing on student learning outcomes that demonstrate competency. However, this was tempered by a recognition that there is a paucity of research and evidence for such outcome measures.

R1: "I recommend continued focus on student learning outcomes with less emphasis on prescriptive requirements".

R5: "I think it is a good idea (outcomes –based assessment) but we tend to only set the standards at the minimum. I think we need more. We need to be very prescriptive."

The word trees (Figs. 2 and 3) developed from the verbatim quotes of transcripts from the participants, illustrate the context of 'prescriptive' and 'outcomes' in the interview transcripts and provides perspective of the CCE respondents thinking. These Word Tree displays are produced by the Nvivo software as a graphic representation of the results of a text search query. They represent the context in which the word occurs.

Theme 4: more resources please

All but one of the respondents commented that the questions raised in the interviews were relevant but could not be dealt with by CCEs because they were run voluntarily by chiropractors without expertise or were under-resourced. Resources most commonly identified were financial in nature and targeted at research for improving the quality of CCE assessments, interventions and staff / member training. The word tree, Fig. 4, also developed from the verbatim quotes of transcripts from

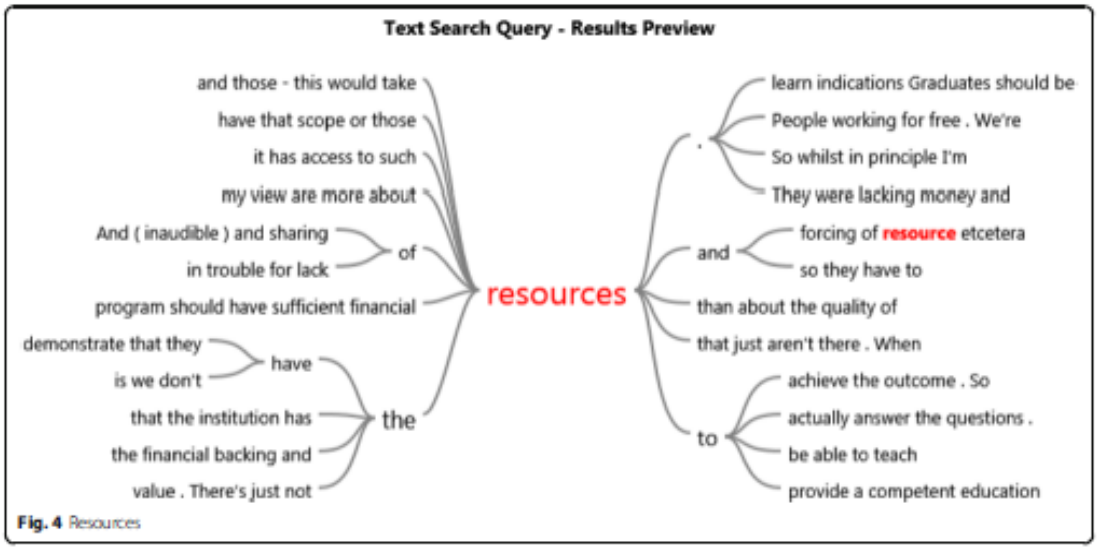

Fig. 4 Resources

the participants, illustrates the context of "Resources" in the interview transcripts and also provides perspective of the CCE respondents thinking.

R4: "And another one (way to improve quality of CCEs) is from a different angle is CCEs if they had unlimited funds or - you know sort of generous funding they could also look to fund research and perhaps sponsor activities within a programme to run trials as to whether they would be helpful or otherwise".

R6: "Just saying that they need to be valid assessments without giving them any guidance is challenging because most chiropractors who are in academia and CCEs do not have an education background. They're practitioners. And you can't expect that they're going to understand and know that or even the managers. And I think it's kind of obvious that they don't".

Theme 5: inter professional integration

Seven of the nine respondents thought that chiropractic practice was too isolated and needed to be more integrated into mainstream healthcare. Chiropractic graduates were thought to require a greater capacity than that was currently being demonstrated by practicing chiropractors to communicate more effectively with other healthcare professionals, with the perceived end result being improved patient care.

R1: "So inter-professional skills - you know as much as they can be put into standards or part of curriculums (sic) there's almost a complete need to be there because we - we're not good at this, we're not good at having conversations with other professionals. We're not good at relating to other professionals. As a profession we are somewhat paranoid".

Theme 6: CPs making ends meet

The necessity for a CP to remain financially viable was mentioned by several respondents as a possible factor in several related issues that CCEs encounter. This included; CPs inappropriately lowering student admission requirements, confidentiality of accreditation processes being used to avoid CP brand damage when they perform poorly thus potentially negatively impacting on their enrolling student numbers, a motivator of unethical student practice behaviours on graduation, and a difficulty for CPs that are part of a university trying to obtain adequate funding.

R8: "And it's a motherhood statement - a major sort of a motherhood statement I guess I think institutions are driven by motivations other than producing the highest quality graduates. I think some of the motivations have more to do with bums on seats and the amount of money that they can generate."

Discussion

Overview

This is the first study to explore CCE views on accreditation standards and processes of CPs. Six themes were found throughout the semi-structured interviews. The respondents thought that CCE activities frequently involved having to negotiate diverse and strongly held differences in opinion from professional groups. The education of students about chiropractic practice was thought to need to become more interdisciplinary in nature while doing so without losing the 'uniqueness' of chiropractic. Respondents were diverse in their views on how CCEs should go about their business of accrediting CPs and improving the quality of chiropractic graduates.

Finally, CCEs were viewed as being without sufficient resources to undertake their roles and thought that financial drivers were important motives for poor CP performance.

Theme 1: professional differences

The current accreditation standards, according to many of the CCE experts in this study, were a result of a negotiated settlement between disparate interest groups (vitalists versus evidence-based) and resulted in standards that allow all chiropractic views to co-exist. Some respondents in this study, in accord with the educational position statement, have advocated for the removal of *vitalism* from CPs [48]. Also respondents in this study are in accord with the recent World Federation of Chiropractic Education consensus statement calling for the support of an evidence-based teaching and learning based environment as the way forward for chiropractic education [49]. Moreover research of medical accreditation is demonstrating that accreditation standards need to begin with a review of the evidence-base for each standard [50]. 'Unorthodox' views have direct implications for patient safety and quality of care, for example anti-vaccination beliefs and the non-guideline use of X-rays [32]. We contend that the primary considerations by CCEs should be for patient safety, efficiency and quality of care and not a careful negotiation between past and present concepts.

In our opinion, negotiated settlements on accreditation standards or silence by CCEs that are driven by inclusive considerations are untenable if chiropractic is to become an integrated respected mainstream healthcare health profession. Chiropractic education delivered by CPs, and accredited by CCEs, must whole heartedly adopt patient-centred and evidence based drivers.

Theme 2: keep it in the family

The view by the CCE experts in this study that only chiropractors should be involved in CCEs for the establishing, monitoring and decision making of accreditation standards and processes of chiropractic education is challenged by studies in other healthcare professions [51, 52]. In a recent systematic review, only modest evidence could be found to support the importance for including medical doctors in the composition of governing bodies of healthcare organisations and hospitals [53]. Studies included in this review found that higher levels of performance was found in those medical doctors who were dedicated to their organisational role, had further management training and were not in part-time practice at the same time. Another included study found that low performance was most obvious in organisations where there was a low number of senior medical consultants that exerted a disproportionate influence over organisational priorities [53]. It is possible that there are similarities between medical practitioners and chiropractors when they are trained as health practitioners and then become involved in managing general organisational–operational business performance.

These findings suggest that CCEs may be well served to recruit appropriately trained full-time managers, who are not necessarily trained as chiropractors, but rather have strong management and strategizing skills. The potential upside is considerable, as it would provide CCE with people who can manage disparate voices and plan and organise complex and difficult strategies, such as the implementation of an evidence-based approach. In addition, this evidence suggests there would be a greater potential for promoting interdisciplinary interaction.

Alternatively chiropractors who work for CCEs could be funded to pursue advanced degrees in areas such as adult education theory and pedagogy. This approach has the possible benefit of allaying concerns about losing the 'uniqueness' of chiropractic by not requiring non-chiropractors to be in oversight roles. Ultimately however, research is required to explore how well chiropractors manage expected operational and management roles in CCEs is required to confirm whether or not these assumptions of similarities can be drawn with medical practitioners in organisations. Some CCEs have had full-time staff for many years, sometimes non-chiropractors, and these could be a rich source of data for further qualitative inquiry.

Theme 3: focus on outcomes or be prescriptive?

Most respondents' views in this study were in accord with the international trend in medical education to move toward competency-based education [33, 54–56]. Purported benefits are a shared set of expectations around a common descriptive language for education that increases accountability for stakeholders [55, 57] and new avenues to assess overarching competencies, such as communication [56]. However, some respondents raised concerns, also expressed in the medical accreditation literature, that there is considerable heterogeneity in how the outcomes are defined, developed, implemented and assessed [54, 58, 59]. Consequently, some accreditation researchers have argued for a 'hybrid' model that contains both prescriptive detail and an outcomes-based approach [60]. This was also the case for some respondents in this study who expressed a desire for the retention of minimum numbers. For example, the number of patient treatments before graduation.

A hybrid system raises at least two important questions. First, what is chiropractic and its attendant scope of practice and second, what is the best model to deliver the most relevant education for those seeking to become

chiropractors in the twenty-first century of healthcare? For example, should a chiropractic curriculum include courses on x-ray physics and positioning in the twenty-first century when the minority of chiropractors purchase x-ray equipment and clinical practice guidelines do not recommend the routine use of x-rays? Also some geographic regions have their curriculum content determined by requirements beyond the CCE alone. For example, the CPs in the USA and Canada need to prepare students to pass National Board examinations in subjects that some would deem irrelevant or inconsistent with the research evidence such as microbiology, histology and embryology [61].

These issues present a number of complex challenges for CCEs. The proffered pursuit of advanced education for CCE members and drawing on expertise from other accrediting bodies may go some way to assisting in this journey. Several studies suggest that the creation of language definitions (for example "chiropractor") is critical to research and development of a set of equivalent evidence-based accreditation standards and processes that will be educationally useful [62, 63] and indeed this may be a starting point.

Theme 4: more resources please

This results of this study suggests that CCEs are staffed by chiropractors who have, and continue to, generously provide time to voluntarily participate with the intention of improving the quality of chiropractic care. Consideration needs to be given to ways to appropriately fund CCEs. This will likely require differing strategies for each CCE region and further qualitative interviews with participants from CCEs, CPs, professional associations and other regulatory or government agencies may generate possibilities. With the right level of resources CCEs could, among others, employ experts from allied healthcare disciplines, deliver training for executives in leadership and fund advanced degrees in education for CCE members for decision making about accreditation standards for the twenty-first Century. Also it could fund training for financial, management and organisational strategy skills, site inspection teams, and fund research for improved language clarity in their accreditation standards. It would also allow CCEs to be composed of larger numbers of skilled executives and avoid the accusation of low numbers of senior members with a disproportionate influence over CCE priorities [53].

Theme 5: inter-professional integration

Respondents spoke of the need for increased interdisciplinarity for chiropractic education and practice. This is difficult for many CPs as the educative process predominately takes place in private colleges and they are not exposed other health professionals in the classroom or clinical setting. There are successful examples in Denmark and Switzerland where this has taken place and this appears to be facilitating the integration of chiropractic into mainstream healthcare [64].

Research has identified barriers, albeit in practicing chiropractors, to improving inter-professional relations and this includes practitioners perceiving that their treatment model is preferable to biomedical alternatives [18]. Another factor seems to be a mindset that chiropractic is "unique" or "separate and distinct" [65]. Social Identity theory explains this as an 'us versus them' mindset [66, 67]. There are several educative possibilities that may assist in challenging this instinctive thinking. For CPs the obvious, but often expensive and time intensive option, is hospital placements for chiropractic students. Another possibility may be to form a collaboration with other universities or colleges that offer multiple health professional training programs and require students from differing disciplines to combine to undertake a common assessment task or project (either face-to-face or on-line).

CCEs may wish to further explore options by opening dialogues with other allied-health or medical education accreditation agencies to explore ways to facilitate interdisciplinary communication [31, 68, 69]. Often allied and medical accrediting agencies have expended large amounts of time, money, research and expertise refining their standards and process for accreditation [29].

Theme 6: CPs making ends meet

Many CPs are private programs (especially in the U.S.A.) and are tuition dependent. According to the respondents in this study, this appears to create pressure on them to relax admission standards in order to remain financially viable. CCEs control over this issue is limited to setting standards of educational excellence for training clinically competent chiropractors.

Financial concerns as generators for poor behaviour of education providers is not restricted to CPs. Aggressive and potentially misleading recruitment practices, poor ethical practices, and inappropriate commercial influences have been documented in other health education programs [70, 71]. Dialogue with other health professional education accreditation agencies who have successfully managed this issue may be useful.

It is curious that CCE respondents did not raise the issue of high student loan debts and default rates. This appears to especially problematic in the U.S.A [72]. Here, students have been shown to demonstrate inadequate financial literacy [72]. CCEs may have a role to play in ensuring the curricula of CPs are appropriate and adequate to address this literacy concern.

Strengths and limitations

This study sampled the views of nine experienced CCE past and present members with an average of 14 years' experience and a response rate of nearly 70%. We were not able to compare responders to those who refused to participate (non-responders). Several participants had experience on a number of CCEs. We are confident they have provided a rich insight into the issues surrounding CCEs. However, as this was a qualitative study, our sample cannot be assumed to be representative of the views of all members of all CCEs internationally and could be influenced by community bias. The authors are confident they have addressed the issues surrounding qualitative research of reflexivity [73], credibility, transferability, dependability and confirmability [47].

Recommendations

This study has led to the identification of a number of issues and, based on these as well as the available literature, the authors make a number of individual recommendations that are summarised in Table 2. If these recommendations are adopted, then outcomes such as a uniform high standard of practitioners who are evidence-based and lifelong learners is likely to be enhanced across all CCE-controlled regions. This would help ensure and safeguard the international trust in practitioners' ability to deliver ethical, safe and quality care across world-wide borders.

Conclusions

The aim of this study was to report on key informant opinions of Councils on Chiropractic Education (CCE) regarding recent research findings reporting on improving accreditation standards and processes for chiropractic programs.

To this end, respondents were asked their views on a number of issues arising from these recent studies that have identified issues and possible explanations. Six themes were found across the semi-structured questions.

Diverse professional interest groups were viewed as creating considerable conflict within CCEs and these conflicts were pivotal in the formation of negotiated accreditation

Table 2 Summary table of recommendations for CCEs

	Recommendation	Justification
1	Internationally uniform definitions of basic terms such as chiropractic, diagnosis, and scope of practice are required.	Uniform and high quality methods of assessment for student learning-outcomes, and site inspection reports can be created to create standardised assessment of CPs across CCEs. Common standards would ensure and safeguard patient safety and care and be good for global workforce standardisation.
2	Use acquired definition and scope of practice for the creation of reliable and valid measures for assessing student learning.	Uniform assessment of CPs can allow for more accurate baseline measures from which quality improvements can be monitored.
3	Funding sources be identified for CCEs.	This would allow CCEs to conduct their own quality improvements such as staff training and employ highly qualified people without a conflict of interest
4	CCE executives should ideally be full-time.	Part-time practice and part-time organisational involvement leads to poorer executive performance levels.
5	CCEs composition should include non-chiropractors with managerial and organisational strategy skills.	This would provide CCEs with skill sets to manage the varied professional interest groups, establish standardised training for members and site inspections, develop strategies to increase CP compliance, and have a greater potential for promoting interdisciplinary.
6	CCEs should consider specialised further education for their executive members relevant to their roles.	As above.
7	Facilitate research that explores an outcomes-based and prescriptive approach to the competency levels of graduating chiropractic students. For example, the number of classroom hours, the number of patient treatments.	This will develop, inform and improve regulatory standards.
8	Actively regulate and remove Vitalism and 'subluxation' from CP curricula unless it is taught in a historical context.	Align chiropractic education with contemporary evidence-based approaches to health profession education.
9	Engage with other health disciplines education accreditation bodies.	Gain expertise and research for quality improvement of accreditation standards and processes
10	Adoption of a patient-centred approach to accreditation standards and processes	Align with contemporary mainstream healthcare.
11	Adopt an evidence-based approach to accreditation standards and processes	Align with contemporary mainstream healthcare.
12	A review of the chiropractic curriculum to remove or streamline outdated courses. For example radiography, histology, and embryology.	To better align chiropractic education with twenty-first Century healthcare.

standards. There is a lack of clarity of important and basic terms such as "chiropractor" and the resultant scope of practice. This in turn has partially resulted in the creation of accreditation standards and processes that allow for the co-existence of evidence-based/evidence-friendly and philosophy driven CPs. This situation is further reinforced by a feeling that there is a 'uniqueness' of chiropractic practice that must be preserved and a lack of financial and personnel resources for CCEs to adequately conduct their business.

Recommendations are made to improve the standards and process of CCEs for (re)-accreditation of CPs, including a widespread adoption of evidence-based approach and changing the focus of CCE accreditation standards to serve the public and patients and not the profession.

Additional file

Additional file 1: Aide de Memoire / Interview questions. (DOCX 17 kb).

Abbreviations

CCE: Council on Chiropractic Education; CP: Chiropractic Program

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None.

Declarations

None.

Authors' contributions

SI, BW and CLY were responsible for the study design. SI and VC undertook the data analysis and interpretation. SI developed the initial and iterative draft. VC was responsible for reviewing the initial draft and structure. All contributed to the final version. All authors read and approved the final manuscript.

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Ethics approval and consent to participate

Ethics approval was granted from the University Human Research and Ethics Committee (Project No 2018/055).

Consent for publication

Not applicable.

Competing interests

Bruce Walker (BFW) is Editor-in-Chief and Charlotte Leboeuf-Yde (CLY) is Senior Editorial Adviser of the journal *Chiropractic & Manual Therapies*. Neither played any part in the assignment of this manuscript to Associate Editors or peer reviewers and are separated and blinded from the editorial system from submission inception to decision.

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Publisher's Note

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Part 2: Analyses of particular responses to research findings

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A perspective on Councils on Chiropractic Education accreditation standards and processes from the inside: a narrative description of expert opinion

Part 2: Analyses of particular responses to research findings

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Abstract

Background: This is the second article reporting on a study that sought the views of people with extensive experience in Councils on Chiropractic Education (CCEs) on research that has raised concerns about variability in accreditation standards and processes for chiropractic programs (CPs) and chiropractic practice in general.

Methods: This qualitative study employed in-depth semi-structured interviews that consisted of open-ended questions asking experts about their thoughts and views on a range of issues surrounding accreditation, graduate competency standards and processes. The interviews were audio-recorded, and transcribed verbatim in June and July of 2018. The transcripts were reviewed to develop codes and themes. The study followed the COREQ guidelines for qualitative studies.

Results: The interviews revealed that these CCE experts were able to discern positive and negative elements of the accreditation standards and processes. They were, in general, satisfied with CCEs accreditation standards, graduating competencies, and site inspection processes. Most respondents believed that it was not possible to implement an identical set of international accreditation standards because of cultural and jurisdictional differences. This was thought more likely to be achieved if based on the notion of equivalence. Also, they expressed positive views toward an evidence-based CP curriculum and an outcomes-based assessment of student learning. However, they expressed concerns that an evidence-based approach may result in the overlooking of the clinician's experience. Diverse views were found on the presence of *vitalism* in CPs. These ranged from thinking vitalism should only be taught in an historical context, it was only a minority who held this view and therefore an insignificant issue. Finally, that CCEs should not regulate these personal beliefs, as this was potentially censorship. The notable absence was that the participants omitted any mention of the implications for patient safety, values and outcomes.

Conclusions: Expert opinions lead us to conclude that CCEs should embrace and pursue the widely accepted mainstream healthcare standards of an evidence-based approach and place the interests of the patient above that of the profession. Recommendations are made to this end with the intent of improving CCE standards and processes of accreditation.

Keywords: Accreditation, Chiropractic, Competence, Qualitative, Council on chiropractic education, Vitalism

Background

This is the second article reporting on a study exploring accreditation standards and processes of chiropractic education. The role for the training of chiropractors is undertaken by Councils on Chiropractic Education (CCEs), which oversee the regulatory and educational standards for chiropractic education providers. These standards are outlined in their written documents. They are composed of a description of the competencies a student is expected to attain before graduation as well as a set of requirements for chiropractic programs, among others, curriculum content, facilities, and staff.

Previous studies have raised concerns in a number of areas of the accreditation processes conducted by CCEs [1–5]. These have included variability in standards between accrediting agencies [6], lack of an evidence-based (EB) approach [2], inclusion of non-evidence-based philosophies such as *vitalism* and *subluxation theory* [3]. Also, non-evidence-based beliefs have been identified in chiropractic students, who are resistant to the educative process [7], as well as deficits in their understanding of non-indications for care [5]. Finally, a relationship between chiropractic student personality traits and their clinical decisions has been demonstrated [4]. These issues probably reach beyond pedagogy and have implications for patient safety, quality of care and workforce mobility [8–15].

In Part One, the opinion was sought on each of these matters from CCE experts, as they may have valuable insights into CP regulatory matters and could corroborate and improve our understanding of the complexities of these concerns, as well as suggesting possible solutions (Part 1, Innes et al., in press). A qualitative approach was taken, because past research exploring these themes encountered an unexpected reluctance to respond to a survey [16], and a qualitative methodology facilitates the exploration of complex phenomena like this [17, 18].

When the CCE experts were asked for their views on these concerns, six common themes emerged across the five issues listed above. These were CCEs organizations had to negotiate a diverse profession with strongly held views that frequently resulted in conflict and they had to do this with limited resources. The respondents believed chiropractic should be integrated within the healthcare community, but efforts should be made to preserve its uniqueness. Concerns were expressed by respondents that profit motives often drove chiropractic program behaviours, and there was a wide range of views on how best to assess chiropractic programs for accreditation. These themes were over and above the interview questions and warranted separate reporting and discussion.

In this Part Two article we report on the responses of the CCE experts to each of the concerns posed in the interview questions and attempts to garner the diverse discussion and controversial professional responses found.

Aim

The primary aim of this study was to explore the experience and beliefs of CCE experts of (re)-accreditation standards and processes of CP by seeking their views on the following issues:

I. All CCEs should perhaps implement an identical international set of competencies for all chiropractic students to achieve before graduation.
II. All CCEs should implement an identical set of accreditation and re-accreditation standards for CPs. This would include minimal staff qualifications and student hospital placements.
III. The processes and standards of site inspection teams of CPs.
IV. CCEs should watch over CPs to ensure students learn important course material. For example, learning the appropriate contra / non-indications for chiropractic care or helping students and CPs educators understand how student personality, attitudes, and beliefs may impact on clinical decision making.
V. Vitalism and evidence-based practice in CP course material.

Method

This was a qualitative study utilizing in-depth semi-structured interviews in-person via Skype or telephone. The derivation of the questions has been detailed in the first study (Part 1, Innes et al., in press) and the interview questions (*aide de memoire*) are attached in Additional file 1. Ethics approval was obtained from the university Human Research Ethics Committee (2018/055) before recruitment and data collection.

Participants and recruitment

Nine expert participants were recruited from thirteen email approaches. The full details of CCE member sample size, recruitment, consent, and confidentiality management are detailed in the first study (Part 1, Innes et al., in press). Two key representatives were sought from each of the 5 CCEs. The final sample consisted of nine participants (6 men and 3 women) who had an average of 14 years-experience with at least one CCE, two of whom were non-chiropractors. The interviews were conducted from May to July of 2018 and lasted between 32 and 62 min, with an average duration of 44 min.

Data collection

Data were collected from consenting participants using a semi-structured in-depth interview process via Skype or

telephone, because the respondents were located at a distance, both nationally and internationally.

The principle researcher conducted the interviews (n = 9). The nine participants were provided with the interview questions, generated from previous research findings, prior to the interview and invited to reflect on the questions. Participants were invited to make further comments as they felt appropriate to the topics under discussion. An *aide de memoire* was used to ensure consistency across all the interviews (Additional file 1).

Data analysis

The data analysis is also detailed in Part One (Part 1, Innes et al., in press) but in summary the issues of trustworthiness of data and interpretation of the study required addressing credibility, transferability, dependability and confirmability [19]. The transcriptions were returned to the interviewees for verification of accuracy to increase credibility. The interviewer was familiar with relevant CCE documentation [1–3, 20]. This helped ensure credible interpretation of the interactions with the participants, thus improving methodological rigour [21]. To attain dependability and confirmability of the data, the analysis process (using NVivo 11 software) as outlined by Braun and Clarke [22],was reviewed by another qualitative expert. The interviews were reviewed by the lead researcher and discussed with a qualitative research investigator, until they agreed that thematic saturation had been reached. They agreed this occurred after the ninth interview. Implications of these findings were discussed and a list of recommendations compiled.

Results

The CCE experts, when responding to the possibility of implementing identical international CCE standards, stated that their views were the same for both the expectations for students' graduation competencies and the written accreditation standards for CPs. Consequently, the graduate competencies and accreditation standards findings were grouped together.

Standards for competencies of graduating chiropractors and accreditation

Suggestions for changes to improve the domains and subdomains of CCEs standards?

Six of the nine interviewees could not think of any changes to the domains and subdomains of their respective CCEs standards for the improvement of graduate competencies and accreditation standards. One third of the nine felt that the 'real issue' was how to facilitate CPs to want to seek compliance rather than be forced to achieve a set of standards. All respondents spoke of the inherent ambiguity in language. That is, one word may have different meanings for different cultures or societies. Consequently, the respondents spoke of the need for more work on definitions and on the terms commonly used in accreditation standards to resolve this lack of clarity. The words most often cited were "chiropractor" and "diagnosis". The possession of more detailed definitions was thought to result in an increased ability to assess CPs as well as to create a more portable international workforce.

> R2: "I don't think actually it's an issue of improving the standards per se. As it is to get compliance. And I think that's the bigger issue".

Is it possible to create identical international standards?

The task of achieving identical international standards was seen to be unachievable because of cultural differences and local jurisdictional variations. It was thought that a more appropriate expression was "equivalence of standards". To this end three participants thought that it would be helpful if a core set of standards was created.

> R1: "Absolutely not. The word is not identical competencies but equivalent competencies. We - again at the CCE – we struggled with that a whole lot and I think there needs to be core standards that are much the same across the board and across the world".

This sentiment appears to be at odds with the thoughts of three other respondents who believed that even trying to achieve something fundamental, such as a definition of "chiropractor", was highly unlikely.R2: "Good luck with that (*sic defining chiropractic*) . . . . It's a political issue rather than a clinical issue. And you know when you look at most of the studies on what chiropractors do, most of what they do is neuromuscular skeletal problems".

Views on an EB approach to the formation of accreditation standards and processes

All CCE respondents acknowledged the importance of an EB approach to the formation of accreditation standards. One expressed the view that the entire healthcare community is adopting an EB approach to education and practice wherever possible. Therefore, it is nothing more than what should be expected of CCE's. However, five of the nine respondents added caveats, such as, there is no evidence for everything a chiropractor does and the practitioner's clinical experience is an important consideration in accreditation standard development. Two thirds of the CCE representatives thought that research into these standards was needed and that CCEs were strongly positioned to

guide and inform it. However, it was contended that CCEs were under-resourced to do this research themselves.

> R1: "To have a strictly evidence-based practice is probably not necessary and probably a hindrance in that you've got to keep yourself from using stuff that is truly valuable".

The process and standards of site inspection teams of CPs

Views on the ability of site inspection teams to monitor CP compliance

There was widespread but conditional agreement that site inspection teams formed a valuable part of the monitoring process of CPs. At least one third of the respondents thought that important issues were obtaining team members who had the necessary personal qualities, such as interpersonal and critical thinking skills. Additionally, team members were deemed to require an understanding of the accreditation standards, be experts in their field, and have prior experience. Further, the teams themselves should be well resourced, carefully trained and led by a skilled leader. Two respondents commented that there was only a small pool of chiropractors available to choose from for this task and that more consideration should be given to including experts from outside the profession.

> R5: "My view is that the training of the team members, generally speaking, is not very good. They need to be prepared to process lots of information. Some of the team members are not very good at this. They need to know how to collect data and interpret it. In other ways most of the team members tend to struggle with this task. They need to have critical thinking skills to be able to do all this. It is very difficult and involves a lot of training".

Respondents also thought that inspection teams needed to be able to see through CPs that submitted "glowing" self-evaluation reports or attempted to hide deficiencies. Respondents also spoke of the importance of pre-inspection knowledge or intelligence from sources outside of the CP self-evaluation report (students, staff, and professional chiropractic association members).

Views on the ability of site inspection teams for quality improvement of CPs

Approximately half of the participants thought that carefully constructed experienced teams, which have developed a strong rapport with CPs were an important source of thoughtful and meaningful suggestions for continued improvement. Many respondents thought that site teams offered CPs located within a university setting a means for leverage to bring about changes with the threat of the removal of accreditation. Possible changes mentioned were more full-time staff, funding and removal of unnecessary curriculum requirements.

> R6: "So I think it could go both ways, but I've seen many examples where the site evaluation report has been instrumental in making improvements. And also provided the impetus especially if they're part of universities. So, they have this report, now this professional team's accrediting body has said we need to do this. And that gives them ammunition. It's not just the faculty or the management of the programme saying".

Should final site inspection teams' reports be made public?

Respondents were either strongly in favour of transparency or thought it was a "conundrum". Reasons for publishing findings of CP site inspections included; exposure of bad behaviour forced change, the public has a right to know, it is standard practice around the world and in other health professions, and CPs are resourceful and can manage the stress of adverse findings. Reasons against disclosure were; it is distressing for CPs and can damage their image, confidentiality is a facilitator of open and frank disclosure by CPs to CCEs and the public cannot understand the complexities around (re) accreditation processes. One CCE expert reported no adverse effects from publishing the site inspection team's final report on their website and could see no reason for others not to do so. Finally, several respondents thought that there is not uniformity in site team evaluations and this would mean that disclosure of inequitable levels of scrutiny was unfair for CPs.

> R9: "But if they think that it's going to be divulged to the public there's so much competition that is out there for students - you know there are unscrupulous institutions, universities, CPs, you name it, that would use public information to damage the reputation of another programme ... And so if these - if the self studies were to be made public I think you would end up with them being much more benign, whitewashed, lacking some of the critical appraisal that we encourage institutions to have when they're writing their self studies."

Factors relevant to ensuring students learn important course material

Should CCEs ensure students learn core material e.g. contra/non/indications for care?

One third of respondents thought that it was necessary to make sure students know core material and that this

warranted inclusion as a formal accreditation standard. However, half thought that this was likely to be contentious because of the lack of agreement on what core material would likely be. For example, there is a diversity of opinions on the reasons for spinal manipulation. Some groups of practitioners would believe that regular spinal manipulation prevents a range of non-musculoskeletal conditions, while others would see it as providing short-term pain relief. Consequently, the indications for spinal manipulation are better not prescribed.

> R1: "But in as much as we feel that a chiropractic adjustment given from time to time or regularly has preventative value how do you measure something that you've prevented. . . . . This is the argument that would float around the table if we were in an accreditation setting."

Should there be minimal faculty qualifications?

Two thirds thought that the difficulty with seeking faculty with high levels of academic qualifications, such as a PhD, was that it might preclude good teachers who have clinical experience. Many held reservations that a highly academically qualified person was not necessarily a "good" teacher with sound pedagogy. One expressed the view that mandating highly qualified staff imposed a much higher wages cost for CPs.

> R3: "*In other words, an instructor may hold a PhD but have no teaching credentials or competencies, which would not optimize the educational process*".

Should chiropractic students have a hospital placement experience?

Almost half of the participants believed hospital experience would be an important step for integration of chiropractic into mainstream health care. This experience was seen as improving communication between mainstream healthcare and chiropractic as well as enhancing student diagnostic skills. Two CCE responders thought that the benefits did not outweigh the likely cost and difficulty of arranging placements.

> R7: "It's the only way forward to get inter-disciplinary understanding of the profession and transfer of knowledge between professions".

Should students be taught insight into their own personality?

One third of respondents commented that they had not thought of personality as being a factor in clinical decision making. The remainder thought that, although likely a factor, would not warrant inclusion as a consideration in a formal statement in accreditation standards.

What is the CCEs role in chiropractic students' non-evidence-based beliefs?

Of all respondents, six stated that non-evidence-based beliefs of students should be dealt with by CPs teaching an EB approach and / or greater critical thinking skills, or as R3 stated "*how to learn, not what to learn*". Other suggestions included open debate about the curriculum regarding these issues, employing more faculty that are EB, and that this is a post-graduate continuing education issue rather than a requirement of an accrediting agency. Two respondents felt that it did not warrant a dedicated accreditation standard. Finally, one CCE informant felt that the phenomenon of non-evidence-based beliefs warranted careful exploration as to their origin and proffered that solutions most probably lay in regarding them as being analogous to religious beliefs.

> R6: "But it needs - yeah we need experienced faculty. Evidence based faculty and then approach it that way."

Evidence-based approaches and vitalism

Your thoughts on vitalism in CPs?

Half of the respondents thought that *vitalism* in chiropractic education was an impediment for the integration of chiropractic into mainstream health care. Two respondents stated that it was too difficult to write standards to prescribe against *vitalism* being taught other than in a historical context. Interestingly, one responded refused to comment on this question.

> R7: "Because we're seeing institutions graduating with a vitalistic model which is inconsistent with modern healthcare. And the reason they're being accredited is because they're ticking all the boxes. . . . On the one hand you're teaching them (students) everything that's evidence based. It's physiology, it's biology, it's psychology. All the things that we have good evidence for understanding. And then we're saying "And then you've got magic." And those two things don't mix very well. . It's spoken and not written. . . . . And policing that is difficult."

Some suggested it was better to do nothing and, to use the words of R1, "*turn a blind eye*" to *vitalism*, as it is always going to be there, is only championed by a minority of practitioners, and was too hard to deal with.

In contrast, two other respondents thought that the role of the CCE was to act as an accreditor and not a regulator.

By acting as a regulator CCEs activities would likely result in inappropriate censorship.

> R3: "The devotion to vitalism or other theories falls under the doctrine of "academic freedom". Students and instructors should remain unrestrained in their pursuit of ideas and theories. Accreditation has no role in deciding which theories or beliefs are included in course material."

Your thoughts on an EBP approach in accreditation standards for CPs?

One third of participants thought that there was insufficient emphasis placed on an EB approach to education and practice.

> R1: *"It (EBP) should be everywhere. Especially in patient care. It should be in lights."*

Four of the nine responders expressed reservations about a "totally" EB approach. Concerns were voiced that this involves a heavy emphasis on randomised-controlled studies, which may not always be applicable in specific instances. This in turn was thought to lead to the stopping of many helpful chiropractic techniques because of the lack of any supportive evidence. Finally, an EBP approach was thought to likely result in a reduction of the importance of the practitioners' clinical experience and knowledge. No respondents mentioned patient preference, values or safety as a consideration.

Discussion

Summary of findings

The interviews revealed that respondents were, in general, satisfied with CCE accreditation standards, graduating competencies, and processes. They did not believe it was possible to implement an identical set of standards across all CCEs because of cultural differences. Rather, they stated that it would be better to create a core set of standards that were approximately the same or equivalent and these would require clear definitions of key words such as "chiropractic" and "diagnosis".

Mixed views were expressed on the making public of final site inspection team reports of CP accreditations. Teaching skills and clinical experience of academic staff were valued at least as highly as attaining higher qualifications such as a PhD degree. A hospital placement for students was seen as offering a means to better integrate chiropractic into mainstream health care.

While respondents thought favourably of using an EB approach to accrediting CPs, they expressed some reservations that this might lead to the loss of valuable aspects of chiropractic practice, for which there is an absence of evidence. CCE experts thought that the most appropriate way to deal with students' non-EB beliefs was for the CP to be evidence-based. Finally, there were mixed views on the presence of *vitalism* in CPs. Half of the respondents thought that the teaching of vitalism in CPs was an impediment to the integration of chiropractic in mainstream healthcare and that it was very difficult to police in CPs. It was also stated that so few held this view that it was probably not worth the effort of writing prohibitive standards. Others thought that *vitalism* was a matter of academic freedom, and accreditation has no role in deciding whether this should be included in CP curriculum.

General discussion of implications

Standards for competencies of graduating chiropractors and accreditation

Suggested improvements to CCEs standards & identical international standards? The respondents were generally satisfied with the existing accreditation standards and processes. The CCE experts thought that improvements would come from increased engagement by CPs in accreditation processes that should be constructed around a clearly defined and assessable set of core equivalent standards rather than identical standards.

This view of the CCE experts resonates with current research investigating medical accreditation that has identified as a major challenge to reforms is the lack of a common understanding of the terms and words used by stakeholders [23]. The lack of clarity of language negatively impacts on the engagement of all the stakeholders, creation of a shared agenda, establishing of goals, and methodologies for evaluating changes [23]. As such, definitions are of great importance and, therefore, become the starting point for reform [24, 25].

Part One of this study found that current CCE accreditation standards do not contain detailed definitions and standards, because they have to accommodate a diverse range of intra-professional views, such as *vitalism*, in CPs [5]. Part Two adds further detail, by finding that it is also due to the downplaying, or even refusal to comment, because of the difficulty in writing standards for a minority issue. This suggests that the creation of a clearly defined set of standards will be an unlikely event as the respondents in this study saw great difficulty in arriving at an agreement on the fundamental issues, such as a definition of "chiropractic".

Views on an EB approach to the formation of accreditation standards and processes There is a recognition by the participants in this study and chiropractic educators of the need to improve the quality of chiropractic all over the world with global consistency in accreditation and assessment of chiropractic education [26]. Medical education has demonstrated that this is

possible, when it is founded on a scientific and EB approach to the clinical sciences and practice [27]. Previous studies found that the uptake by CCEs and chiropractic practice in general of an EB approach has been slow and incomplete [2, 28, 29], and this also appears in the response of some participants in this study, who wanted to defer to clinician experience as the most important factor in making clinical decisions. It is the authors' contention that chiropractic internationally should wholeheartedly embrace this approach. The basing of the entire chiropractic curriculum upon an EB approach would require a substantive effort and consensus among CCEs to allow for updating of their accreditation standards and afford the opportunity of becoming more relevant to twenty-first century chiropractic practice.

Some suggested areas of scrutiny would be the number of hours required for courses in X-ray physics and positioning in an era where clinical practice guidelines around the world are advising against the routine use of spinal x-rays, the replacing of chiropractic philosophy courses with increased hours in understanding and interpreting research evidence, and teaching students how to run solo / private practices, where the focus will be on motivating and sustaining behavioural changes to manage chronic health co-morbidities associated with persistent or recurrent spinal / musculoskeletal conditions such as obesity.

The process and standards of site inspection teams of CPs

The respondents in this study expressed confidence in the site inspection process to monitor and apply accreditation standards. However, research has found that site inspections are of unknown reliability [15], underinvestigated [30–32], the teams are often poorly trained [33], poorly selected [34] and in need of a standardised report structure for a comprehensive assessment measured against the accreditation standards [31]. This raises the concern that the confidence expressed by the CCE experts in the site inspection processes may have been ill-founded. For example, a lack of standardization of site inspection is seen by the presence within the same CCE of CPs who openly adopt a *vitalist* focused curriculum [35] and those who have signed a declaration that *vitalism* has no place in the modern curriculum, as the belief that it is the cause of disease is unsupported by any type of evidence [36]. A move toward transparency by making final site inspection team reports public may create greater accountability and explain how this heterogeneous situation can exist.

CCE experts in this study viewed site inspection teams as an important lever for quality improvement. This monitoring and reviewing role places them in a position to facilitate the introduction of identified innovations to teaching found in recent research, such as the impact of students' personality on their clinical decisions [4]. Consideration may also be given to the common practice in academia of the inclusion of colleagues who come from different professional or academic backgrounds that often brings different and insightful points. Another common practice worthy of consideration, as the consumers of the education under review, is the obligatory inclusion of student reviewers as members of inspection teams [37]. In addition, they could also address deficiencies like inadequate case mix in chiropractic teaching clinics [38] by helping CPs explore hospital placements, also recently shown to address this issue for chiropractic students [39]. To this end CCEs could develop a core standard for clinical competency that encourages CPs to provide greater interprofessional clinical training opportunities.

Factors relevant to ensuring students learn important course material

Should CCEs ensure students learn core material e.g. contra/non/indications for care? The preference to be accommodating of diverse views was also seen in the reluctance of CCEs experts to mandate that chiropractic students know the contra/non/indications for spinal manipulation. Contemporary research is calling for the cessation of non-indicated care or low value care as an important measure to reduce the financial burden of low back pain on societies [40, 41]. On the surface, the primary concern appears to be consideration of the profession. An EB approach would see the three aspects of research evidence, clinician expertise and patient values and circumstances as the drivers for such decisions [42]. We contend that the application of this framework would yield a different response to the importance of CCE standards appropriately and adequately ensuring the learning of core material.

What is the CCEs role in chiropractic students' non evidence-based beliefs? The experts in this study were unsurprised at the presence of non-evidence-based beliefs in chiropractic students. The almost unanimous view was that this issue was best dealt with by the CPs taking an EB approach. If this was an effective strategy, then logically it should follow that levels of chiropractic student non-EB beliefs would decrease over the duration of the CP. This was not the case in two Australian university-based chiropractic programs [7]. The most significant influences in these students' beliefs and attitudes were external peers and their past experiences [43].

This phenomenon has also been studied in osteopathic treatment in Britain [44]. Here, osteopathic 'philosophy' was found to be seen as superior to science and distorted the way practitioners and students view, judge and reject the results from research evidence and guidelines. This 'lens' elevates the value of personal experiences, anecdotes

and the teachings of 'expert' therapists, above results from systematic reviews and meta-analyses.

This offers a possible explanation of why the presentation of evidence does not change non-EB beliefs in chiropractic students. It is overly simplistic to think that EB content alone will ensure that students will graduate without non-EB beliefs. Rather we are swayed by the respondent in this study who thought that investigations for solutions be focused on regarding non-EB beliefs as being analogous to ideological or indeed religious beliefs.

Should there be minimal faculty qualifications? Respondents commonly expressed the view that clinical and teaching expertise and research training (such as a PhD) in chiropractic educators are in some way mutually exclusive. We suspect the finding that medical faculty with outdated knowledge of research methodologies, poor skills in critical evaluation of medical information were barriers to the adoption of EB medicine would also apply to chiropractic faculty [45, 46]. If chiropractic education and the profession is to continue to establish itself as a credible and mature health profession, then there needs to be an emphasis on not just training semi-skilled consumers of research but also on facilitating increased numbers of post graduate researchers and research active academics within chiropractic programs [47, 48]. CCEs standards may include expectations toward this end. Also this could include courses in adult learning and pedagogy for chiropractic faculty to address reservations that having a PhD does not make one a "good" teacher. Also, CCEs standards could encourage the CPs to hire faculty with advanced degrees in education.

Evidence-based approaches and vitalism

Your thoughts on vitalism in CPs? CCEs are in a powerful position to embed an EB approach into educational providers' curricula and to improve patient outcomes as well as further align chiropractic with accepted healthcare standards [49–52]. Many chiropractic educators do not believe that students should be learning how to conduct their own original research. Instead, they need to learn how to become good "consumers" of research evidence [2]. It may be possible for CCEs to agree on a minimum number of courses about research evidence in the chiropractic curriculum that teach chiropractic students the principles of acquiring, appraising and applying research evidence in clinical practice. This could be further scaffolded with the teaching of an understanding of how systematic reviews are conducted and clinical practice guidelines are developed.

The authors agree with the respondents in this study, who view the role of the CCE as providing peer view of the CP educational processes with an emphasis on what is best for the student. However, the authors respectfully disagree that this is their sole remit and that *vitalism* falls outside their working brief. Non-EB beliefs or philosophies have implications for patient safety and quality of care and should be a CCE consideration. In Canada non-EB beliefs have shown to be associated with high levels of anti-vaccination attitudes, use of non-evidence-based treatment choices, non-guideline use of X-rays and low levels of inter-professional collaboration [6]. Further, in a group of people, conscious of protecting the chiropractic profession, a critical approach to non-EB and overenthusiastic clinical approaches might have a stronger protective effect when dealing with such issues. Also, we are cognizant that there are other professional regulatory bodies that act to protect the health and safety of the public and that this task does not rest solely with CCEs.

The recent WFC education conference delegates statement [26] echoed the need for CCEs to become also regulators, with the public's safety at heart. In addition to the questions of research evidence and clinician expertise, CCE organizations need also ask themselves the bedrock question of their accreditation standards and processes "Does it make care better for patients?" [53].

Strengths and limitations

The strengths and limitations of this study have been discussed in the article titled A perspective on Councils on Chiropractic Education accreditation standards and processes from the inside: A narrative description of expert opinion. Part 1: Themes. In brief, this was a qualitative study with few participants, meaning that the findings are not representative of the views of all members of all CCEs internationally. Consideration should also be given to the possibility of community bias. However, the sampling had been designed to garner views from experts within all CCEs and 9 of 12 CCE experts accepted participation. The CCE participants had an average of 14 years' experience, which caused us to be confident they have provided a rich insight into the issues surrounding CCE matters. Anonymity probably ensured honest and open answers and the responses were in line with concepts already encountered in previous surveys and in personal communication with this type of persons. Also, the authors are confident they have addressed the issues surrounding rigour in qualitative research through reflexivity [54], credibility, transferability, dependability and confirmability [21].

Recommendations

As in Part One of this study, the interviews with CCE Experts has raised several issues and, based on these as well the available literature, the authors make a number of recommendations (Table 1), in particular, the concerns about variability in accreditation standards and

processes for chiropractic programs (CPs) and chiropractic practice in general.

The intent is for the tables from Part One and Part Two to complement each other and not repeat common issues. These recommendations are intended to create a uniform high standard of practitioners who are more likely to be in accord with the mainstream healthcare standard of an EB approach across all CCE-controlled regions. This would ensure and safeguard the international trust in chiropractors' ability to deliver ethical, safe and valid care across and within international borders.

Conclusions

The overarching aim of this and the previous study (Part 1, Innes et al., in press) was to explore the experience and beliefs of CCE experts about variability in accreditation standards and processes for chiropractic programs (CPs) and chiropractic practice in general as well as making recommendations for improvements.

We found that when experts are queried about the 'inner life' of the CCEs, they can discern between positive and negative elements in the CCEs procedures. They can also explain, in an understandable way, the difficulties encountered in determining the aims, objectives of the CCEs standards and also in the actual execution of the accreditation process.

However, there was a considerable diversity of opinions on many topics.

We interpreted the reasons for the considerable variability between chiropractic programs worldwide to be embedded in a political negotiation process of CCEs determining their standards. The result has been a polite acceptance of 'philosophical' or "ideological" views of some chiropractors. In other words, the group of chiropractors, who favour mainly a musculoskeletal approach, co-habitats with those chiropractors who believe that chiropractic treatment also has an effect on a range of non-musculoskeletal conditions. This results in standards and procedures that are sufficiently non-specific to allow for both types of institutions to pass the CCE accreditation requirements.

This has real world implications. From a public health perspective, chiropractors who are practicing from a 'philosophical' perspective (non-EB) are more likely to prevent the adoption of chiropractors in the mainstream medical world.

We argue that the "raison d'être" of CCEs is not to solely oversee a chiropractic education that encompasses

Table 1 Summary table of recommendations

	Recommendation	Justification
1.	Creation of an internationally acceptable set of equivalent accreditation standards and processes	For greater public confidence, graduate chiropractic homogeneity and workforce portability.
2.	An EB approach be adopted for accreditation standards and processes.	Facilitate the integration into mainstream health care.
3.	Standardized inspection team member selection, training and format for reporting.	Improve the quality of CP assessment and quality improvement processes for improved educative processes.
4.	Broaden the scope for site inspection team composition e.g., students, academic colleagues	Gain broader insights into the issues facing CPs and their possible solutions.
5.	Facilitate research to explore the optimal mix between an outcomes-based and prescriptive (hybrid) approach to the competency levels of graduating chiropractic students.	This will develop, inform and improve accreditation standards.
6.	Make site inspection team reports public.	This is the broader societal expectation and will align chiropractic with the mainstream standards of transparency.
7.	Move toward minimum faculty qualifications of a PhD.	This would improve the educational standing of CPs and enhance research capability and quality.
8.	CCEs standards may include expectations for courses in adult learning & pedagogy for chiropractic faculty.	This would address reservations that having a PhD does not make one a "good" teacher.
9.	CCEs standards could encourage the CPs to hire faculty with advanced degrees in education.	To scaffold the teaching quality of CPs to improve student learning outcomes
10.	Provide student hospital placements	Improve graduate student quality and interdisciplinarity skills.
11.	Develop a core standard for clinical competency that ensures a meaningful student clinical training experience	Graduates are better prepared to engage in safe and effective practice.
12.	Investigate innovative dimensions of student clinical decision making such as personality type.	Improve graduating students' clinical decision-making skills.
13.	Address unorthodox (vitalism and 'subluxation') practice patterns in CCE accreditation standards.	Align chiropractic education with contemporary EB approaches to health profession education.
14.	The development of a core standard for literacy in critical thinking	This would result in an increased ability to consume research evidence and translate this into practice for improved patient outcomes.

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all understandings of chiropractic practice. We recommend that the key question for accreditation bodies is "Does it make for better patient care?" and we call on CCEs to take a stand and better serve the patients' best interests and not the conservative chiropractic profession.

To this end we have made recommendations that include CCEs embracing and pursuing an EB approach, which in the end will place the interests of the patient above that of vested segments of the profession.

Additional file

Additional file 1: Interview Questions. (DOCX 17 kb)

Abbreviations
CCE: Council on Chiropractic Education; CP: Chiropractic Program; EB: Evidence-based

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Authors' contributions
SI, BW and CLY were responsible for the study design. SI and VC undertook the data analysis and interpretation. SI developed the initial and iterative draft. VC was responsible for reviewing the initial draft and structure. All contributed to the final version. All authors read and approved the final manuscript.

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CHAPTER 8: Thesis Discussion

Aim of thesis

The aim of this thesis was to closely scrutinize international chiropractic educational and practice standards. This aim was selected to identify matters that may require change to enhance the reputation and quality of chiropractic education. The ultimate goal was to assist chiropractic training to ensure patient safety and quality of care.

Results in general

The research conducted demonstrated that there are many commonalities shared between the various CCEs in their interpretation of how a CP should go about the process of educating a student to acquire the necessary competencies to safely and effectively enter the workforce. There is a high level of agreement when the descriptive language was broad. For example, all CCEs agree that a CP should produce a chiropractor, who on graduation can assess, diagnose and treat a patient.

These standards become increasingly dissimilar in the level of prescriptiveness, as they drill down to describe the various domains and subdomains. This is unsurprising, as there is no common understanding of the basic concepts and terms used, and this is best seen in the terms “chiropractor”, “diagnosis” and “competency”.

The process of amalgamating all the CCEs graduating competencies, accreditation standards and processes, as well as those from the World Federation Medical Education, plus the available additional evidence and keeping in mind the best interests of the patient, allowed us to make recommendations that should create an homogenised, internationally consistent, and high-quality set of CCE standards and processes.

The creation and legislating of “top down” laws have been demonstrated to be a poor driver for change in healthcare systems [33]. Rather contemporary models, such as Complexity Science, ask for an understanding of the role of all stakeholders and the system, in which they meet before any implementation of strategies. Consequently, we sought to understand the “zeitgeist”, with the intent of better informing efforts to recommend effective changes to improve this system.

We learned throughout these studies that the word “chiropractic” is used to identify a non-homogeneous group of people who are accredited health practitioners. For some, this title serves as a descriptor of a ‘traditional’ group that subscribes to the concept that the spine is the centre of good health and for others, an ‘evidence-friendly’ faction that focuses on musculoskeletal problems based on a contemporary and evidence-based paradigm. These polar positions are joined by a group who are somewhere in the middle and appear to have no strong allegiance to either faction and do not feature in the strategic thinking of CCEs or their standards. This ‘spectrum’ was illustrated by the studies in this thesis exploring chiropractic students’ non-EB beliefs and the resulting clinical decisions they make.

The title “chiropractic” holds considerable personal value as the self-worth of people is intimately related to the group they identify with [211]. It is therefore not surprising that the practice of chiropractic is viewed as “unique”, in need of preserving and protecting, and best understood and judged by its own kind. This likely explains the resistance to some of the topics in the studies in this thesis, those exploring site inspection processes and practitioner beliefs and attitudes.

Thus, it is observed that with the passage of time we see the evolution of a set of accreditation standards and processes that allows for this heterogeneous group to co-exist. The findings of this thesis strongly suggest that this has been achieved by strategies of content omission. This includes not defining foundational terms, avoiding prescriptive details in the standards and processes, being silent on *vitalism*, not setting minimal faculty qualifications, not expecting CPs to teach material that steps on the toes of ‘traditionalists’ e.g., non-indications for care, and not looking beyond the

chiropractic profession for other possibilities for improvement. Perhaps the most telling of all is the lack of wholeheartedly embracing an EB framework, the industry standard for mainstream healthcare professions. This is perfectly illustrated by the anti-science expectation in two CCE accreditation standards that a student should be able to examine a "*subluxation*"; a theoretical construct without validity that cannot be reliably detected [212]. This has not been a chance circumstance. People working with CCE accrediting bodies are cognizant of, and comfortable with, the issues resulting from negotiated settlements between these diverse and disparate groups.

This "broad church" or "big tent" approach explains how students can start and graduate from CPs with non-EB beliefs about chiropractic and its practice. This belief system appears to be resistant to the educative process in all years of the CPs investigated. This 'traditional' thinking clings to a belief system that over-rates the likely therapeutic benefit of spinal manipulation and plays out in the unnecessary delivery of non-indicated care.

We also learned that there are positive signs that the journey from craft to profession is happening, albeit slowly. As an example, there are the beginnings of evidence of a general "soft" and "conditional" acceptance of the mainstream healthcare education standards of a scientific method, an EB practice approach, and competency-based assessment of student learning outcomes. Further, the definition of chiropractic appears to be moving slowly toward that of a practitioner who deals with musculoskeletal issues. Also, CCEs appear open to the possibility of exploring innovative dimensions to accreditation such as the example provided in this thesis of the impact of personality on clinical decision making.

We consider that while the chiropractic profession views itself as unique, it nonetheless faces the same challenges as all other healthcare professions, when educating future practitioners. Namely, CCEs standards and processes require reliable and valid measures of CPs performance and student learning outcomes. These must be built on detailed definitions as well as carefully constructed and validated instruments. This thesis contains one such measure (The Chiropractic Student Questionnaire) and

with further validation across all Australian CPs, could go part of the way to addressing this issue.

CCE informants were cognisant of the negative and positive elements in the CCE procedures as well as being aware of the difficulties encountered in determining the aims and objectives of CCE standards and their execution. While some CCE experts argue that their role is to support and improve how a CP goes about educating its students, we argue that the "raison d'être" of CCEs is to take a more upfront stand and better serve the patients' best interests. This can be accomplished by embracing and pursuing the scientific model and an EB approach to clinical practice, like other health professions.

One of the CCE expert respondents in Part 2 of the qualitative studies in this thesis claimed that Vitalism fell outside the brief of CCEs standards as it was a matter of "academic freedom". In 2009 Fuller defined academic freedom as "a system of complementary rights and obligations entitled to teachers and students as free enquirers"[213]. CPs should be not be denied this fundamental right. However, academic freedom does not give CPs or their instructors "carte blanche" to teach whatever they desire. "Academic freedom" is to be held in tension with "academic duty" which requires sustained competency in pedagogy, graduate competency essentials, and accountability [214, 215]. In doing so career competence and adherence to accreditation standards are supported [216]. Consequently, "natural order" requires CCE accreditation standards to become guides for CPs as opposed to standards being constructed to accommodate the "devotion to Vitalism or other theories". This recommendation places even more importance on the need for accreditation standards for graduating chiropractors to be in accord with those of other healthcare professions, namely driven by the societal expectations of evidence-based practice and patient-centred care.

Implications of research

Six of the twelves studies that comprise this thesis contained recommendations sections. Each of these have been extracted and included as Appendix 1 to allow for an easier over-view by the reader. The recommendations from this thesis for action are formed with the intent of creating revitalised, effective, and transparent CCEs.

There are two possible scenarios: CCEs act and make changes on of these recommendations (some or all) or they do not.

If CCEs choose to act, then it is of paramount importance that they be sufficiently resourced. This will enable them to be appropriately and adequately staffed to go about their business, both nationally and internationally. CCEs will be able to recruit a range of skilled people, from within and outside the profession, to develop and implement strategies to engage CPs. This should ultimately impact on the profession and move all parties toward a wholehearted and uncompromising pursuit of an EB and patient-centred approach to education and clinical practice. This new undertaking would be underpinned and informed by a funded research agenda. This agenda would see, among other things, CPs directed and supported towards areas that require further exploration, such as outcome measures for accreditation purposes.

The recommended re-vitalisation of CCEs will see them directing and supporting research that explores the underlying drivers related to the origin and maintenance of 'traditional' chiropractic thinking. Good work has been initiated with chiropractic students in France, demonstrating how 'traditional' values results in excessive care [25]. This needs to be extended to practitioner samples. While this type of study justifies CCEs taking a prescriptive approach to *subluxation* and *vitalism*, it also runs the risk of driving these beliefs and practices underground, so they become a hidden curriculum. Consequently, research is required to investigate ways to challenge 'traditional' belief systems and move CPs, students and practitioners along the 'spectrum'. Complexity science posits that all actors should be engaged in any system

changes. This means that CCEs will need to work alongside all stakeholders and research a wide range of possible mechanisms to lever change. Consequently, these studies will include the public (including health consumers), other health disciplines, professional associations, government agencies, and health insurance companies.

CCEs must be equipped to deal with the eventuality of conflict and push-back from vested interests that will almost certainly arise from those holding a more uncompromising approach. The evidence outlined in this thesis identified the challenges to 'traditional' chiropractic care. One contemporary publication seeking evidence based change in the profession has been rebuked by a 'traditional' chiropractic news site as "Subluxation Deniers Publish Flawed Paper" [217]. The 'traditional" chiropractors mounted a passionate defence of the right to teach *vitalism* in CPs during the re-accreditation process by the CCE-USA with the United States Department of Education in 2012 [218, 219]. Financial resources may be required for legal sequelae as "traditionalists" seek to defend their philosophical views if CCE efforts to engage and move the chiropractic profession along the 'spectrum' are unsuccessful.

With funding and the will to act, CCEs executives can draw on the expertise necessary to create a definition of chiropractic that is based around evidence, research, and the interests of the public and not the preservation or protection of the profession. This foundational task will in turn inform the expected graduation competencies, standards and processes required of CPs for accreditation and re-accreditation by CCEs to produce graduating chiropractors who can practice safely and effectively. These re-vitalised CCEs will also need to include the expertise and funding to guide research into formulating changes in accreditation standards and processes that will continue to improve the educative processes of CPs. The effectiveness of which, should be trialled and monitored.

A re-vitalised CCEs could possibly be able to engage with, and learn from, other healthcare profession accreditation experts and join with them in public health initiatives and research. They will consider feedback from a wide range of

stakeholders. An expected consequence of this communication will be the exploration of improved inter-disciplinary experiences such as hospital teaching and practice placements. Finally, CCE executives will act to become transparent. They will publish member qualifications for the processes they undertake, the criteria used for deriving standards and procedures, and final site inspection reports.

Currently, not all CPs 'belong' to its regional CCE [28]. Some come under the jurisdiction of a government system or have none, particularly, in third world countries. It is envisaged that the re-vitalised CCEs could become widely recognised as centres for accreditation excellence and quality improvement, thus drawing all CPs under their umbrella. Further, these entities may also be able to assist other manual therapy professions in third world countries in their transition from craft to profession.

The other possibility is that CCEs make no changes. I have shown that the chiropractic profession is already adept at constructing standards and processes that allow for inaction to be employed as a strategy, for example the perpetuation of non-EB CPs and practices to persist. Inaction will allow the current situation to continue. A polite accommodating acceptance of all belief systems reinforces the status quo, and this compromises public safety, highlighted by anti-vaccination agendas found among some 'traditional' practitioners. The notion of a spinal lesion (*subluxation*) that is the centre of health (*vitalism*) and requires correction by a chiropractor stands in contrast to the growing number of voices advocating the reduction of low-value care and assisting patients to become self-managers as the way ahead for reducing the financial impost of chronic LBP for economies [16, 17]. It is the authors view, and a topic of intended *post-doctoral* work, that the *vitalist* / s*ubluxation* mindset does not align with contemporary models of 'patient-centred' care. This antiquated model of healthcare has not seen the continued growth of utilization rates of chiropractic care in the past 35 years [13]. Nor has it assisted the establishing of a progressive identity and cultural authority for spinal care. Based on the findings of this thesis inaction will see chiropractic care as remaining predominately in private practice and marginalised in the healthcare system with dwindling patient numbers for individual chiropractors.

The question arises of how much longer governments and health agencies will tolerate this inaction that allows practitioners to support, from a non-EB philosophical perspective, anti-vaccination beliefs and the non-guideline use of diagnostic tests such X-radiation and irregular therapies.

Strengths and Limitations

This thesis produced a series of firsts. It was the first thesis to explore the accreditation of chiropractic education. It began with best practice systematic reviews of the documented written expectations that informed the language of the system involving CCE executives, CPs, students, and practitioners. This resulted in the ability to provide a list of recommendations as a starting point for the improvement of the accreditation processes.

Further, we were the first to use the case study exempla of chiropractic students, as actors in this system, to investigate how their beliefs, personality, and attitudes might interact with the accreditation expectations. The sample was limited to two Australian CPs, which were signatories to the Clinical and Education Position Statement by SOFEC and this indicates they were actively pursuing an EB approach to chiropractic education and practice [113]. Sampling from CPs aligned with 'traditional' chiropractic values may have produced different findings and would be a worthy post-doctoral project and as such may be a limitation of this thesis.

Another limitation was the unexpected resistance encountered from CCEs and chiropractic practitioners. This obstruction resulted in a change of research direction resulting in a qualitative methodological approach to obtain the information initially sought. The results proved to be a strength as we gained broad ranging and rich insights into the CCEs actions and inactions. We captured the opinions of nine CCE experts and this most likely reflected more generally the CCEs views on these matters, but there is a chance, that not all of these insights are generalizable to all CCEs.

Another limitation was that we did not include all aspects of accreditation. We did not include an analysis of Self-Evaluation Reports (SER) in this thesis. The cost / benefit of the SER process, as well as its reliability in CCEs accreditation processes remains unknown and warrants further investigation. Also, the criteria for how staff, practitioner and non-practitioner members of the various CCEs are selected was also unstudied.

Future research

Several CCE experts questioned the "quality" of the students being admitted to chiropractic programs. These informants raised the concern that some CPs appeared to be motivated by profit and were accepting inadequate students into their program. Consequently, they concluded, some of the students were not capable of mastering the complexity and volume of information required to practice competently. This potentially has public safety considerations and should sit high on the agenda for future investigations. The issues already discussed in this thesis of the standardization of CP assessment and the creation of valid and reliable measures of student learning outcomes will assist CCEs assessing the adequacy of CP admission criteria. A systematic audit comparing the admission criteria of CPs for similarities and differences will also assist in identifying strengths and opportunities for quality improvement.

This thesis limited the investigation of unwanted chiropractic practice characteristics to the domain of CCEs. Obviously, this is not the only agency that has a role to play in professional conduct. In Australia there is a professional regulation board (the Chiropractic Board of Australia) [220] appointed by the Australian government through the Australian Health Practitioner Regulation Agency [221]. There is also the Australian Competition and Consumer Commission [222] who ensure that individuals and businesses comply with Australian competition, fair trading, and consumer protection laws. Professional associations also hold the potential for self-regulation. Finally, there is the force of public opinion. These are all "actors" in the system and as such warrant further research and scrutiny. Similar, authorities exist throughout the first world.

Qualitative studies with key personnel from recognised regulatory bodies may create a better understanding of the way each organization views its role, inter-regulatory boundaries, and possibilities for collaborative efforts.

Obviously, unwanted characteristics can also be a result of other post-graduation influences. New graduates, fresh from a structured and regulated learning environment of a CP, will eventually find themselves seeking employment. For chiropractors this will nearly always be in a private practice setting. The reality and necessity of having to generate an income means that graduates will be offered, and will accept, employment in *vitalist / subluxation* practices. There have been anecdotal reports of recent graduates who, when placed in this situation, adopt the associated unwanted characteristics of such practices. Qualitative studies exploring the views of recent graduates and influences on new graduates may inform longitudinal studies of factors that influence professional conduct and practice behaviours.

There is a need for a standardised definition of chiropractic that is agreed upon by all CCEs. This will enable research to establish a standardized curriculum. A statement commonly heard and read throughout this thesis was “jurisdictional and cultural differences”. Further investigation is required to identify what such differences may be and how they impact on the scope of practice and the requisite clinical skills that are detailed in accreditation standards.

The qualitative approach of interviewing CCE experts proved to be a rich source of information. Further, it circumvented the resistance encountered in two of the studies in this thesis. Our understanding of the complex nature of accreditation standards and processes could be further enhanced by interviews with other stakeholders such as those responsible for accreditation within CPs (Heads of Program) and representatives from the various chiropractic factions of “traditional”, “evidence-based” and those who fall somewhere in between.

Some countries have manual therapists who use, among other techniques, manipulation and are not chiropractors. These practitioners are often trained using a

‘passed down’ or “master to apprentice” method that, like chiropractic, carries a rich and valued history. As these developing countries look to improve the standards of musculoskeletal care and formalise their education they may have to deal with similar issues identified in this thesis. The monitoring of CCEs and the changes they trial to improve the quality of student graduates may inform other manual therapies as they transition from craft to profession. As such it should be carefully and thoughtfully documented.

A strength of this thesis was the inclusion of the internationally recognised evidence-based accreditation standards of the World Federation Medical Education for comparisons with CCE standards. There is scope to continue this comparative process by contrasting other evidence-based accreditation agencies such as physical therapists / physiotherapists who have been accepted into mainstream healthcare for similarities and differences.

Future research and graduate competencies (knowledge, skills and abilities)

This thesis began by reviewing the literature for the knowledge, skills and abilities required for competency. The intent was to identify the known evidence surrounding the formulation of standards for a graduating chiropractor. The existing research across healthcare training in general has been highly cognizant of the trend toward competency-based education and its inherent assessment difficulties. Most obvious, as discussed in this thesis, is the quantifying of competencies.

The research specific to chiropractic education and practice to date has only explored teaching interventions that may impact on student learning outcomes. It has not identified or quantified the appropriate knowledge, skills and abilities / attitudes that are required for competent chiropractic practice.

Studies of the perceptions of chiropractors about their competence reveal mixed findings. Recently graduated European chiropractors felt underprepared for practice in competencies such as interprofessional collaboration, contributing to professional and scientific knowledge, and practice managerial roles [27]. Disconcertingly, there was considerable variation in these competencies depending on the CP of graduation. This finding adds weight to concerns raised in this thesis about the need for reliable and valid assessments of CPs. This is reflected in studies that have explored practitioners, who have been trained under these various CCEs expressing concerns over their competence to manage paediatric health issues [223]. Even when chiropractors are found to be confident in their ability, such as to practice in an evidence-based manner [224], the reality is that many did not use evidence to guide clinical decision making [225, 226].

This suggests that there remains a paucity of studies that interpret competency frameworks and translate them into meaningful or quantifiable knowledge, skills, abilities and behaviours for CP curricula and teaching. This thesis has shown that CCEs cannot agree on a common definition of "chiropractic". Also found was that in part, this lack of consensus appears to have led to different expectations of the knowledge that constitutes an undergraduate program. Some very recent work has sought to try to rank the importance of CCE accreditation criteria by a consensus process [227]. This seems premature when there is no clear definition of what "chiropractic" and its attendant scope of practice is. It seems prudent to begin with this definition process before undertaking the much needed research of finding metrics for the required knowledge, skills and abilities to competently practice.

The qualitative studies in this thesis suggest that, at this point in time, the derivation of a widely accepted definition seems unlikely. A recent discussion paper has raised the possibility of splitting the profession into two divisions, one containing those who wish to adhere to a vitalist philosophy and a second who desire a contemporary evidence-based approach [8]. Such a divide would pave the way for each party to define the competencies required for their understanding of chiropractic practice and thus

facilitate the exploration of the required competencies. This “divorce” within the profession is speculative and unlikely in the near future. It is the authors contention that in the interim, CCEs should be unerringly guided by an evidence-based practice approach and driven by the protection of patient welfare, especially when contemplating the knowledge, skills and abilities required for accreditation standards.

Future research of CCE organizations

Finally, to monitor performance and provide uniformity, there is a need to find ways to enable oversight of the various CCEs, for both the organization and individual members.

While all CCEs appear to be initially established by their respective chiropractic professions, their place within the higher education setting does not automatically assume quality assurance or oversight of their functions.

The ECCE is an autonomous, or “stand alone”, organisation established by the chiropractic profession in Europe. It has voluntarily undertaken an external review of its standards and processes by seeking inclusion in the European Quality Assurance Register and the European Association for Quality Assurance in Higher Education [228]. CCE-USA maintains recognition by the United States Department of Education as the national accrediting body for Doctor of Chiropractic Programs and chiropractic solitary purpose institutions of higher education [196]. Oversight of the CCE-USA is through recognition by the Council for Higher Education Accreditation (CHEA) and membership of the Association of Specialized and Professional Accreditors (ASPA) and the CHEA International Quality Group (CIQG).

The CCE-International is comprised of member CCEs and is not accountable, or subject to any external oversight [29]. In 1978 the CCE-Canada was granted charter by the Department of Consumer and Corporate Affairs of the Government of Canada and there is no discussion of oversight by the broader educational system [197]. The CCE-Australasia is self-described as an independent and nationally recognised body [229].

All CCE-Australasia decisions appear to require approval from the Chiropractic Board of Australia [230] although there is no mention of oversight or quality control.

Consequently, some are “private” entities or organisations, who have sought oversight, mainly at their own instigation. However, one CCE (CCE-USA) could be better described as “public” and attracts government funding with accompanying quality oversight. Nonetheless their duties remain the same and thus lend themselves to research of optimal structures and processes that ensure high quality accreditation practices.

Final Thoughts

I have practiced as a chiropractor for over 30 years, had the privilege to serve in a regulatory capacity for the profession on the executive of a professional association, and now as an academic, who has recently chaired a committee of a CP that has undergone an active accreditation process. I have seen the best and worst chiropractic has to offer. The words of Michael Klepper “If we don’t make our own future, it will be made for us”, resonate for the chiropractic profession [231]. It is better the profession sheds the coat of our traditions and puts on news clothes for the journey ahead.

Appendix 1: Recommendations made in all studies

The Recommendations and the justification for their inclusion in each study is presented as Appendix 2. This inclusion makes it easier for the reader to follow the evolution in this thesis for the construction of the arguments outlined in the section "Implications for Research".

Study: "Graduate entry-level competencies of CCEs: A systematic review."

Recommendations & Justifications:

Recommendations in relation to CCE understandings of "Competence".

1. An internationally uniform definition of competence for chiropractic education and assessment is required.

This may require agreement from all CCEs on the definition of common words and terms used in their documentation. There is increasing global workforce movement and there is evidence of variations in international standards. Common standards would ensure and safeguard patient safety and care and be good for global workforce standardization

2. There should be separate definitions of competence at different stages of the course work; separating the undergraduate's progress from readiness to graduate.

Chiropractic educators are then better equipped to monitor and assess a student's progress toward detailed graduating standards.

3. "A*bilities"* and *"other categories"* should be included in the definition of competence and their meanings clarified among CCEs.

This would create a clearer understanding of the required standards to be assessed and achieved by chiropractic educators.

Recommendations in relation to domains

4. A clarification of the use of the terms and words used to describe the domains of competency should be undertaken so there is an established understanding of their meaning among CCEs.

High levels of descriptions reduce the capacity for ambiguity as they clearly state the expected behaviours and standards of graduates.

5. Common domains of competency need to be created for chiropractic education.

These domains should reflect not only practitioner behaviours but also qualities and roles. Consideration should be given to recent examples such as CanMEDS and the ACGME

Adoption of these structures would also improve the likelihood of mainstream integration.

6. Appropriate descriptive statements should be found that adequately define the domains, sub-domains and their components.

These should be sufficiently prescriptive and unambiguous to establish high standards of practice and reduce the possibility of undesirable practice profiles. E.g., radiology competencies, physical examination, and pathophysiology expectations.

7. CCEs should consider the evidence for a more prescriptive approach to component descriptive statements that would set clearly defined quality graduation standards for educators to achieve and CCEs to enforce.
8. The term “evidence-based” should be used for improved research and knowledge application, such as patient safety and treatment improvements from other mainstream medical disciplines.

   The adoption of an evidence-based approach would help facilitate integration into mainstream health care.

Further it would facilitate communication and integration within the broader health field. Content taught should be required to be done in the context of the evidence that underpins it.

9. Increased description of ethical and professional practice and practitioner behaviours which are consistent across all CCEs.

Clarity would ensure and safeguard high professional standards.

10. Imaging competencies need to include contemporary modalities such as MRI, CT and diagnostic ultrasound

Health care technology is constantly changing and chiropractic education should keep pace with these changes, so that patients benefit from access to these emerging imaging technologies.

Recommendations for research

11. CCEs should guide and fund research into accreditation matters to develop, inform and improve regulatory standards: suggested areas include, but not limited to;

a) A study comparing CCEs' levels of enforcement of competency standards.

Identifying the opportunities for improving enforcement of standards may result in a uniform quality international standard of patient care and safety of practice.

b) A study of factors that may be at odds with competency standards.

Identification of these factors may provide opportunities and mechanisms for chiropractic educators to improve competency levels.

c) A study trialling interventions targeted at improving identified unwanted practitioner profiles which may alter practice behaviours.

This would improve the quality of patient care and safety.

Study: “Accreditation standards of CCEs: A systematic review.”

Recommendations & Justifications:

Recommendations for definitions of “Educational Standard”

1. All CCE documents should contain a definition of the term “educational standard” and it should provide enough profession-specific detail to be professionally useful for chiropractic programs.

Chiropractic educators would better understand the concept of an educational standard if it was detailed and can thus more easily meet the required standards

Recommendations for the domains of Educational Standards

2. Add the domain “ethics” to educational standards

This will reduce the likelihood of variable and diverse ethics content in programs and potentially graduate outcomes.

3. Add the domain “distance education” to educational standards

The quality of content and assessment of on-line material should be standardised to ensure uniform and higher quality standards.

Recommendations for the subdomains of Educational Standards

4. Perform a literature review for empirically based methods to successfully formulate and implement a mission statement.

This will make it easier to prescribe and provide an effective mission statement

5. Include comprehensive and specific terminology for identifying and explaining the purpose of the mission statement.

Educators will then have a clearly defined goal in order assist them build a quality program

6. All appropriate stakeholders should be considered and listened to in the developing of mission statements.

This will aligns chiropractors with societal needs and expectations

7. The clinical aspect of chiropractic programs should take place partly in hospitals

To provide an appropriate patient case mix exposure for chiropractic students.

8. There should be a minimum set of financial standards in accord with best international business practice.

To ensure the long term survival of the course and protection of students and staff.

9. Chiropractic program staff must include people with PhD degrees.

To improve the educational standing of chiropractic education.

10. CCEs should encourage research to inform educators of the optimal number of patient numbers, hours or competencies required for student training.

To increase the likelihood that graduates achieve the highest levels of competence.

11. There should be a requirement for multimodal learning in curricula

To improve students' learning outcomes.

12. CCEs should encourage research into which types of learning work best for specific subjects for chiropractic students.

To maximize the teaching/learning situation as much as possible.

13. CCEs should help identify the "core" material required for chiropractic graduates

To economize time at its maximum and keep updated on scientific changes and developments in clinical practice.

14. CCEs should compile publication rates and impact factors as well as successful grant applications for CCE-International dissemination.

To allow for constructive dialogue and comparison on which faculty research and teaching requirements improve program outcomes.

Study: “Chiropractic student choices in relation to indications, non-indications and contra-indications of continued care”.

Recommendations & Justifications:

1. CCEs should adopt the terms contraindication, indication and non-indication in their accreditation standards to improve decision making on whether or not to continue care. This study suggests that there are ways to measure these indicators and that it could be used as evidence of undergraduate and graduate competency.
2. If student milestones require such knowledge, then more emphasis in education should be put on the indications for long-term management, especially in relation to past history and treatment outcome to avoid delivering unnecessary care.
3. There was a lack of improvement over the program duration for ‘non-indicated’ care. One way for chiropractic educators to improve this may be to take a common sense approach to help students understand the concepts better, including their use as a valuable clinical asset.

Study: “CCE-I comparison of accreditation standards from 2010 to 2016”.

Recommendations & Justifications:

We recognise that there is a substantive cost in engaging experts to assist with accreditation, establishing an awards system, conducting an evidence-based review of accreditation standards, trialling them with quality research and publishing the findings in the peer-reviewed literature. Debate exists in the medical education literature over who should shoulder this financial impost [232]. Such a debate will

need to take place for chiropractic education with attention to how such funding can take place without compromising the independence and integrity of the CCE-International.

Recommendations In relation to Standards

1. All participants in the accreditation process and their qualifications for the task are clearly stated. A broad range of participants including health consumers and non-chiropractic educators should be included.

To ensure the construction of accreditation standards are transparent and draw on as wide a range of expertise as possible.

2. A review of the evidence-base of the CCE-International accreditation / educational standards.

This would allow stronger alignment with contemporary medical standards and increase acceptance of chiropractic into the mainstream health care system.

3. A trial methodology of the new standards.

The CCE-International could address potentially problematic areas such as poor comprehension, compliance or uptake.

4. Adoption of industry standards of 'qualifications' for faculty and site investigation team members (as well as appropriate training).

Enhanced CP teaching and research with improved faculty qualifications. Increased quality of site visitation members offers more expertise for quality improvement, and evaluations that are more efficient and effective.

5. Transparency of accreditation processes e.g., publication of (re) accreditation reports and recommendations.

CPs are mindful of public image and marketability and this would reinforce compliance with standards. This also increases consumer empowerment.

6. Regular reviews and integration of emerging research to continually update accreditation standards. Especially with respect to quantifying required CP outcome measures.

This would create more efficient and accurate assessments of CPs.

7. The adoption of an evidence-based approach to all aspects of the teaching and practice of musculoskeletal healthcare.

This is the expectation of society, patients and health care education in general.

8. Create an award system as part of chiropractic accreditation for excellence in education.

To incentivize chiropractic programs to create high quality education and desirable models for other CPs to emulate.

Study: “Qualitative study of CCE expert opinion. Part 1.”

Recommendations & Justification:

1. Internationally uniform definitions of basic terms such as chiropractic, diagnosis, and scope of practice are required.

Uniform and high quality methods of assessment for student learning-outcomes, and site inspection reports can be created to create standardised assessment of CPs across CCEs. Common standards would ensure and safeguard patient safety and care and support global workforce standardisation.

2. Use acquired definition and scope of practice for the creation of reliable and valid measures for assessing student learning.

Uniform assessment of CPs can allow for more accurate baseline measures from which quality improvements can be monitored.

3. Funding sources be identified for CCEs.

This would allow CCEs to conduct their own quality improvements such as staff training and employ highly qualified people without a conflict of interest.

4. CCE executives should ideally be full-time.

Part-time practice and part-time organisational involvement leads to poorer executive performance levels.

5. CCEs composition should include non-chiropractors with managerial and organisational strategy skills.

This would provide CCEs with skill sets to manage the varied professional interest groups, establish standardised training for members and site inspections, develop strategies to increase CP compliance, and have a greater potential for promoting interdisciplinarity.

6. CCEs should consider specialised further education for their executive members relevant to their roles.

The reasons are the same as for Number 5 above.

7. Facilitate research that explores an outcomes-based and prescriptive approach to the competency levels of graduating chiropractic students.

This will develop, inform and improve regulatory standards.

8. Actively regulate and remove Vitalism and 'subluxation' from CP curricula unless it is taught in an historical context.

Align chiropractic education with contemporary evidence-based approaches to health profession education.

9. Engage with other health disciplines education accreditation bodies.

Gain expertise and research for quality improvement of accreditation standards and processes.

10. Adoption of a patient-centred approach to accreditation standards and processes.

This will align with contemporary mainstream healthcare.

11. Adopt an evidence-based approach to accreditation standards and processes.

This will align with contemporary mainstream healthcare.

Study: “Qualitative study of CCE expert opinion. Part 2”

Recommendations & Justification:

1. Creation of an internationally acceptable set of equivalent accreditation standards and graduate competencies.

For greater public confidence, graduate chiropractic homogeneity and workforce portability.

2. Reliable and valid measures for assessing student learning.

Uniform assessment of CPs can create and allow for more accurate baseline measures from which quality improvements can be monitored.

3. An EB approach be adopted for accreditation standards and processes.

Facilitate the integration into mainstream health care.

4. Standardized inspection team member selection, training and format for reporting.

Improve the quality of CP assessment and quality improvement processes for improved educative processes.

5. Facilitate research to explore the optimal mix between an outcomes-based and prescriptive (hybrid) approach to the competency levels of graduating chiropractic students.

This will develop, inform and improve accreditation standards.

6. Make site inspection team reports public.

This is the broader societal expectation and will align chiropractic with the mainstream standards of transparency.

7. Move toward minimum faculty qualifications of a PhD.

This would improve the educational standing of chiropractic education and enhance research capability and quality.

8. Provide student hospital placements.

Improve graduate student quality and interdisciplinarity skills.

9. Investigate innovative dimensions of student clinical decision making such as personality type.

Improve graduating students' clinical decision making skills.

10. Address unorthodox (vitalism and 'subluxation') practice patterns in CCE accreditation standards.

Align chiropractic education with contemporary EB approaches to health profession education.

Appendix 2. Additional Files for Studies

Chapter 5 Additional Files: Student Case Studies

Additional File 1. Student Questionnaire

Participant consent

I have read the information letter and I agree to participate in this survey. Your answers are anonymous.

The survey should take about 10 – 15 minutes to complete.

Thank you very much for your assistance.

Stanley Innes

Lecturer Chiropractic / Health Professions

Murdoch University

Please answer the following questions

Sex: Male ☐ Female ☐

Year of Program: Yr 1 ☐ Yr 2 ☐ Yr 3 ☐ Yr 4 ☐ Yr 5 ☐

1. In your practice will you give advice on	*No or rarely*	*Sometimes*	*Quite often Or often*
prevention of stress			
prevention of cardiovascular disease			
prevention of diabetes			
prevention of musculoskeletal problems			
wellness in general			

2. In your opinion, can chiropractic spinal adjustments	*Definitely not*	*Probably not*	*Don't know*	*Yes, probably*	*Yes, definitely*
Prevent disease in general?					
Prevent chronic back pain?					
Help the immune system?					
Make it easier to give birth?					
Improve the health of infants?					
Help the body function at 100% of its capacity?					
Prevent degeneration of the spine?					

3. **When you have graduated would you like to use one or several specific chiropractic technique evaluation systems which tell(s) you what the problem is. For example SOT, Gonstead, Applied Kinesiology or Functional Neurology.**

Yes □ Yes, probably not □ Don't know □ No, probably □ No □

The following questions are about a specific chiropractic technique known as Functional Neurology (FN).

4. **What is your level of knowledge of Functional Neurology (FN)? Select the single best option from the following:**

☐ I don't know anything about FN

☐ I have only heard the name FN mentioned without further explanation,

☐ I have heard about it discussed by chiropractors and/or students

☐ I have seen a chiropractor use it and/or I know someone who has been treated with it

☐ I know more than that because I have read about it & /or been to one or several seminar (s)

☐ I have been treated with FN myself

☐ I have extensive knowledge of FN. Please explain_____

☐ other: please explain_____

5. **Would you like to learn (more) how to use Functional Neurology (FN)?**

Yes ☐ Unsure ☐ No ☐

6. **Do you think this technique should be taught in chiropractic programmes?**

Yes mandatory ☐ As an elective only ☐ Don't know ☐ Probably not☐

Definitely not ☐

7. **Do you think that this technique holds great promise for chiropractic?**

Yes definitely ☐ Yes probably ☐ Don't know ☐ Probably not ☐

Definitely not☐

4. **CASE SCENARIO A:** The following question is seeking your response to a specific case history. Please read the case history and circle what you think is the most appropriate option from A through to F in each case, numbered from 1 to 5.

A 28-year old man, tennis player by profession, consults you for a right-sided intense neck pain without any radiating pain. You note an antalgic position of the head, no other musculoskeletal signs (no torticollis), no other health problems in particular, normal x-rays for his age, and there are no red flags.
In each of the cases described below, what would you do?

Answer Options:

- **A.** I would treat the patient on my own.
- **B.** I would treat the patient with the assistance of some paramedics & / or physiotherapist.
- **C.** I would treat the patient with the assistance of a general practitioner.
- **D.** I would treat the patient whilst asking the opinion of a specialist such as a neurologist / rheumatologist.
- **E.** I would not treat the patient but refer him out.
- **F.** Other, please explain at the bottom of the page.

1. "Physical examination: very tense cervical musculature, no neuro-vascular problems, right C5-6 painful on palpation, pain 7/10 on a visual analogue scale". **Answer A B C D E F other** _____

2. "Five days later the patient comes back to you: Same clinical signs but the pain now radiates into the right shoulder". **Answer A B C D E F other** _____

3. "Four days later: An MRI reveals a postero-lateral disc herniation at C5-6 which affects the C6 nerve root. There is now a neurological sign: C6 reflex diminished (1+), normal myotomes and dermatomes."

Answer A B C D E F

other_____

4. "Another 4 days later: The neck pain is gone. The neurological signs are obvious: C6 reflex absent (graded as 0), the C6 myotome diminished (graded as 2), C6 dermatome disturbed (reduced sensitivity)."

Answer A B C D E F other

5. "Ten days later: The symptoms and signs are the same as last time but in addition the following is noted: the right leg shows hyperreflexia (graded as 3+), a positive sign of Babinski on the right and slight hypoaesthesia of the right leg."

Answer A B C D E F

other_____

5. CASE SCENARIO B

Please read the following cases and for each case, give the answer that you consider fits best with the decision you would make in a clinical setting.

We have selected an imaginary patient, as described in the box below. Then, different scenarios for this patient are outlined, and you are asked to select ONE of several clinical solutions (A,B,C, etc) as listed in bold letters below.

You can choose between the following management options for each of the cases presented below:

A. **I would refer the patient to another health care practitioner for a second opinion.**
B. **I would advise the patient to seek additional treatment whilst following the patient.**
C. **I would tell the patient that the treatment is completed but that he is welcome to make a new appointment if the problem returns.**
D. **I would not consider the treatment to be fully completed and would try a few more treatments and perhaps change my treatment strategy, until I am sure that I cannot do any more.**
E. **I would follow this patient for a while, attempting to prolong the time period between visits until either the patient is asymptomatic or until we have found a suitable time lapse between check-ups to keep the patient symptom-free.**
F. **I would recommend that the patient continue with regular visits, as long as clinical findings indicate treatment (eg spinal dysfunction or subluxation) even if the patient is symptom-free.**
G. **None of the above. (Please explain at the bottom of this page in legible handwriting).**

These are the basic facts for our hypothetical patient.

"A 40-year old man who consults with you for low back pain (LBP) with no additional spinal or musculoskeletal problems, and with no other health problems.
His x-rays are normal for his age. There are no "red flags".

The case above could proceed in the **following 9 ways** described on the next page.

Please encircle the letter that corresponds best to your clinical judgement in each of the cases.

1. An acute attack of LBP of 2 days´ duration and no previous history of LBP. The pain is completely gone after 2 visits. The patient seems to be an uncomplicated person and capable to look after himself and his back.
What would you recommend? A B C D E F (G)

2. An acute attack of LBP of 2 days´duration and no previous history of LBP. The pain is completely gone after 2 visits. The patient is very worried that the pain will come back again. The patient asks if he could come back regularly to make sure this will not happen.
What would you recommend? A B C D E F (G)

3. An acute attack of LBP of 2 days´ duration and no previous history of LBP. The pain is about 20% better after 6 visits.
What would you recommend? A B C D E F (G)

4. An acute attack of LBP of 1 week´s duration. The patient has had several similar attacks over the past 12 months. The pain is completely gone after 2 weeks of treatment.
What would you recommend? A B C D E F (G)

5. An acute attack of LBP of 1 week´s duration. The patient has had several similar attacks over the past 12 months, but the pain pattern has varied over the treatment period and now, after six visits, the pain is 20% better.
What would you recommend? A B C D E F (G)

6. The patient has had LBP intermittently over the past year. After the 2nd visit, the pain was 50% better but today, after six visits there has been no further change.
What would you recommend? A B C D E F (G)

7. The patient has had LBP intermittently over the past year. After 6 visits, the pain was 80% better, but after a further two treatments the last month, the problem has gradually got a bit worse. **What would you recommend? A BC D E F (G)**

8. The patient has had LBP intermittently over the past year. After the 2nd visit the pain was 20% better, but today, after 6 visits and over the past month, the patient has got gradually worse.
What would you recommend? A B C D E F (G)

9. The patient has had LBP intermittently over the past year. After 6 visits the pain is 20% better. The symptoms come and go for no apparent reason. The patient appears tired and moody.
What would you recommend? A B C D E F (G)

1. **Please circle the number that best corresponds to how much you agree with each item.**

	Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely characteristic of me
1. Unforeseen events upset me greatly.	1	2	3	4	5
2. It frustrates me not having all the information I need.	1	2	3	4	5
3. Uncertainty keeps me from living a full life.	1	2	3	4	5
4. One should always look ahead so as to avoid surprises.	1	2	3	4	5
5. A small unforeseen event can spoil everything, even with the best of planning.	1	2	3	4	5
6. When it's time to act, uncertainty paralyses me.	1	2	3	4	5
7. When I am uncertain I can't function very well.	1	2	3	4	5
8. I always want to know what the future has in store for me.	1	2	3	4	5
9. I can't stand being taken by surprise.	1	2	3	4	5
10. The smallest doubt can stop me from acting.	1	2	3	4	5
11. I should be able to organize everything in advance.	1	2	3	4	5
12. I must get away from all uncertain situations.	1	2	3	4	5

AND FINALLY . . .

2. **How do you think you will rate as a chiropractor compared to other chiropractors in your class?**

Below Average□ A bit below average □ Average□ A bit above average □

Above average □ Don't know□

This completes the survey and please check you have answered all the questions

Additional File 2. Research Team Explanation of Scoring

Neck Pain Case

Below is a description of the five specific management strategies for the neck pain case scenario receiving chiropractic care from which the participants in the survey could select one for each of the five scenarios. The history was for a 28-year old man, tennis player by profession, presenting with right-sided intense neck pain.

The five options were :

- **A.** I would treat the patient on my own.
- **B.** I would treat the patient with the assistance of some paramedics & / or physiotherapist.
- **C.** I would treat the patient with the assistance of a general practitioner.
- **D.** I would treat the patient whilst asking the opinion of a specialist such as a neurologist / rheumatologist.
- **E.** I would not treat the patient but refer him out.
- **F.** Other, please explain at the bottom of the page.

A description of the five scenarios, together with the clinical reasoning (cases 1-5) of the research team for the preferred management strategy for each scenario is provided below.

Case 1. "*Physical examination: very tense cervical musculature, no neuro-vascular problems, right C5-6 painful on palpation, pain 7/10 on a visual analogue scale*".

According to the research team, this case indicates a person without a background of persistent or recurrent neck pain. It is uncomplicated and with no poor psychological profile which is indicative of a good prognosis. The team would have selected strategy A ('I would treat the patient on my own'). As such, referral or co-management was unwarranted and deemed to be an unnecessary strategy and an incorrect response.

Case 2. "*Five days later the patient comes back to you: Same clinical signs but the pain now radiates into the right shoulder*".

Although the pain had spread to the shoulder, there was no other additional neurological progression or other signs or symptoms of deterioration. This case was thought by the team as best being thought of as uncomplicated non-specific neck pain. As such, referral or co-management was unwarranted and deemed to be an unnecessary strategy. Thus the strategy the team would have selected would have been A ('I would treat the patient on my own').

Case 3. "*Four days later: An MRI reveals a postero-lateral disc herniation at C5-6 which affects the C6 nerve root. There is now a neurological sign: C6 reflex diminished (1+), normal myotomes and dermatome*s."

The thoughts of the research team were that this patient had not improved as should be expected. Conservative care had not generated any positive response and hard neurological signs as well as progressively deteriorating symptoms were now evident. The team felt that a change of strategy, referral or second opinion would be a reasonable clinical decision. Thus, they would have selected B, C, D, or E. However, the DTR C6 reflex could be potentially regarded as equivocal, thus the response of A was thought not to be unreasonable. This created the dilemma of all five responses as possibly being correct. Subsequently, the scenario was removed from the analysis.

Case 4. "*Another 4 days later: The neck pain is gone. The neurological signs are obvious: C6 reflex absent (graded as 0), the C6 myotome diminished (graded as 2), C6 dermatome disturbed (reduced sensitivity)*."

This patient is not improving at a level that should be expected despite the number of visits. The patient is resistant to the type of treatment that has been provided so far. There has been evidence of progressive neurological deterioration and symptomatology. The team determined that more treatment was not warranted. Further, the patient should be referred out and that this referral should have the

capacity for advanced imaging as well as more aggressive interventions. Thus the team determined the strategy should have been E ('I would not treat the patient but refer him out"). Any other choice was deemed to be incorrect.

Case 5. *The pain drawing is the same and the accompanying text said: "Ten days later: The symptoms and signs are the same as last time but in addition the following is noted: the right leg shows hyperreflexia (graded as 3+), a positive sign of Babinski on the right and slight hypoaesthesia of the right leg*."

There has now been a considerable time lapse with significant and serious signs and symptoms. The team determined that this was now a serious scenario well beyond the scope of conservative care and would require immediate referral. The team would have selected E as the appropriate strategy ('I would not treat the patient but refer him out"). Any other choice was deemed to be incorrect.

This research team then calculated the number of correct responses for each respondent. A maximum score of 4 and a minimum score of 0 was possible.

Low Back Pain Case

A description of nine scenarios (cases 1–9), together with the clinical reasoning of the research team, and a description of their preferred management strategy for each scenario (not included in the questionnaire) is provided below. This is adapted and discussed in relation to Axen et al., Additional File 3 [202].

Inappropriate "Referral" Strategy - Scenarios 1, 2, and 4.

Case 1. An acute attack of low back pain of 2 days' duration and no previous history of low back pain. The pain is completely gone after two visits. The patient seems to be an uncomplicated person and capable to look after himself and his back.

According to the Axen et al. 2008 research team, this case indicates a person without a background of persistent or recurrent low back pain, with a quick recovery and a

psychological profile that indicates a good prognosis. The Axen et al. team would have selected strategy C ("I would tell the patient that the treatment is completed but that he is welcome to make a new appointment if the problem returns"). Our research team selected the response A as being an unnecessary and inappropriate referral in an uncomplicated simple case of low back pain and was indicative of high levels of IU. Respondents who selected A were given a score of 1.

Case 2. An acute attack of low back pain of 2 days' duration and no previous history of low back pain. The pain is completely gone after two visits. The patient is very worried that the pain will come back again. The patient asks if he could come back regularly to make sure this will not happen.

The thoughts of the Axen et al. research team were that, ideally, this patient should be dismissed, similarly to the case above (strategy C). However, the psychological profile of this patient needs to be taken into account and he should be provided with a sense of security whilst guided by the chiropractor and gradually weaned off to prevent dependency upon chiropractic treatment. The Axen et al. team therefore selected strategy E, with the intent of using a couple more visits to improve the patient's self-confidence. Our research team selected the response A as being an unnecessary and inappropriate referral in an uncomplicated simple case of low back pain, despite the anxiety of the patient and was also thought to indicate higher levels of IU. Respondents who selected A were again given a score of 1.

Case 3. An acute attack of low back pain of 2 days' duration and no previous history of low back pain. The pain is about 20% better after 6 visits.

This patient was not improving at a level and rate that should be expected. Because the basic case states that there are no red flags, the Axen et al. team decided that this case should be reconsidered and a few more attempts made. The strategy that best suited this scenario was D. We did not use this strategy in our analysis as the response did not allow for a clear delineation of an unsuitable referral or practice type.

Case 4. An acute attack of low back pain of 1 week's duration. The patient has had several similar attacks over the past 12 months. The pain is completely gone after 2 weeks of treatment.

This is a recurrent problem according to the past history. If the patient considers that the chiropractic treatment shortened the duration of the typical attack, he should simply return as soon as a new problem is felt to commence. Unfortunately, many patients will fail to do so, thinking that the treatment did not help when it starts up again. The Axen et al. team decided that it might therefore be advantageous to keep an eye on the patient for a while with the intent of finding out if each event of low back pain can be quickly and efficiently treated at a 'cost-effect' time interval (strategy E) or if it is possible to prevent further events (strategy F).

Our research team selected the response A as being an unnecessary and inappropriate referral in this recurrent but uncomplicated case of low back pain. This response was thought to be indicative of higher levels of IU. Respondents who selected A were again given a score of 1.

Consequently, participants' responses of A (referral), that were thought to reflect higher levels of IU, were scored as 1. These were summed for Cases 1, 2, and 4 to produce a score for each respondent that could range between 0 and 3.

Inappropriate "Management" Strategy - Scenarios 6, 7, 8 and 9.

Case 5. An acute attack of low back pain of 1 week's duration. The patient has had several similar attacks over the past 12 months, but the pain pattern has varied over the treatment period and now, after six visits, the pain is 20% better.

This patient is not improving at a level that should be expected despite the large number of visits, indicating that he may be resistant to the type of treatment that has been provided so far. Axen et al. decided that a change of strategy would be required (strategy D) or if the patient is referred out, it would be relevant to keep in touch to be

able to be of support in the continued process (strategy B). This case was not used in our study.

Case 6. The patient has had low back pain intermittently over the past year. After the 2nd visit, the pain was 50% better but today, after six visits there has been no further change.

The study by Axen et al. interpreted this patient as having reached his optimal stage with the present type of treatment and the therapy should, at this stage, either be reconsidered "in-house" or by someone else, indicating strategy A or D.

For the purposes of our study, the research team deemed that the selection of the response based on clinical findings guided maintenance (subluxation / spinal dysfunction) care (Option F) was indicative of an unsuitable practice profile. This decision was thought to represent a need to have a more rigid and prescriptive technique structure which would inform the practitioner what to do. This was hypothesised to be indicative of higher levels of IU. This rationale that formed the basis of our hypothesis and selection for option F was also applied to Cases 7, 8 and 9.

Case 7. The patient has had low back pain intermittently over the past year. After 6 visits, the pain was 80% better, but after a further two treatments the last month, the problem has gradually got a bit worse.

The Axen et al. team used the following reasoning: The improvement seen, to date, may have been independent of the treatment and merely an expression of the typical intermittent pain pattern, or the treatment did have an effect but there is something that re-aggravated the condition. The Axen et al. team therefore reconsidered the case (strategy D) or sent the patient out for an adjunctive approach, such as training, whilst keeping in touch (strategy B).

As previously explained in Case 6, option F was selected by our research team as the incorrect response. This rationale and selection was used again in Cases 8 and 9.

Case 8. The patient has had low back pain intermittently over the past year. After the 2nd visit, the pain was 20% better, but today, after 6 visits and over the past month, the patient has gradually got worse.

This patient has not really exhibited a positive response to the treatment and is, in fact, getting worse. That the patient is gradually worsening is not a normal pattern. Despite the fact that there are no (obvious) red flags, the team would refer the patient for a second opinion (strategy A), because some underlying explanatory condition could have been missed. Again option F was deemed to be inappropriate by our research team.

Case 9. The patient has had low back pain intermittently over the past year. After 6 visits the pain is 20% better. The symptoms come and go for no apparent reason. The patient appears tired and moody.

This patient has not improved at all and there is no obvious (biomechanical) explanation for the intermittent pattern. There are no red flags but there is a need to consider if there might not be an underlying depression or some other disease, afterall. The team would not hesitate to refer out for a second opinion (strategy A).

Scores for cases 6,7,8 and 9 were summed. This produced a possible score for each respondent which could range between 0 and 4.

Chapter 6 Additional Files: Practitioner Survey

Additional File 1. Questionnaire.

Questionnaire Personality & Clinical Decision Making

I have read the Information letter about the nature and scope of this survey. Any questions I have about the research process have been answered to my satisfaction. I agree that by submitting the survey I give my consent for the results to be used in the research. I am aware that this survey is anonymous and no personal details are being collected or used. I know that I may change my mind, withdraw my consent, and stop participating at any time; and I acknowledge that once my survey has been submitted it may not be possible to withdraw my data.

I understand that all information provided is treated as confidential by the researchers and will not be released to a third party unless required to do so by law.

I understand that the findings of this study may be published and that no information which can specifically identify me will be published.

The survey should take about 30 minutes to complete.

Your answers are anonymous.

1. **In general, which of the following technique systems, if any, do you use for the ANALYSING and / or GUIDING of your patient care? Mark all that apply.**

	Yes, as best I can	Parts of it	The technique but not the analysis system	Not at all
Activator ®				
Advanced Biostructural Correction (ABC)				
Applied Kinesiology®				
Chiropractic Biophysics®				
Functional Neurology				
Gonstead technique				
Neuro Organizational technique (NOT)				
Sacro-occipital technique®				
Thompson® Drop-piece				
Other technique system or examination approach:				
Please explain what technique 'other' is				

2. How important is chiropractic philosophy in what you do in your practice? Chiropractic philosophy is defined as the understanding that if your nerve system is working properly the body is better able to heal itself and perform at its full potential and this can help anyone at any time in their life.

0	1	2	3	4	5	6	7	8	9	10
Not all important			somewhat important			very important			Extremely important	

3. How important is subluxation theory in guiding what you do in practice? Subluxation theory is defined as the understanding that vertebral subluxations adversely impact the ability of the nerve system to transmit information and properly control the functions of the body.

0	1	2	3	4	5	6	7	8	9	10
Not all important			somewhat important			very important			Extremely important	

4. **CASE SCENARIO A:** The following question is seeking your response to a specific case history. Please read the case history and circle what you think is the most appropriate option from A through to F in each case, numbered from 1 to 5.

A 28-year old man, tennis player by profession, consults you for a right-sided intense neck pain without any radiating pain. You note an antalgic position of the head, no other musculoskeletal signs (no torticollis), no other health problems in particular, normal x-rays for his age, and there are no red flags.
In each of the cases described below, what would you do?

Answer Options:

- **A.** I would treat the patient on my own.
- **B.** I would treat the patient with the assistance of some paramedics & / or physiotherapist.
- **C.** I would treat the patient with the assistance of a general practitioner.
- **D.** I would treat the patient whilst asking the opinion of a specialist such as a neurologist / rheumatologist.
- **E.** I would not treat the patient but refer him out.
- **F.** Other, please explain at the bottom of the page.

1. "Physical examination: very tense cervical musculature, no neuro-vascular problems, right C5-6 painful on palpation, pain 7/10 on a visual analogue scale". **Answer A B C D E F other** _____

2. "Five days later the patient comes back to you: Same clinical signs but the pain now radiates into the right shoulder". **Answer A B C D E F other** _____

3. "Four days later: An MRI reveals a postero-lateral disc herniation at C5-6 which affects the C6 nerve root. There is now a neurological sign: C6 reflex diminished (1+), normal myotomes and dermatomes."

Answer A B C D E F

other_____

4. "Another 4 days later: The neck pain is gone. The neurological signs are obvious: C6 reflex absent (graded as 0), the C6 myotome diminished (graded as 2), C6 dermatome disturbed (reduced sensitivity)."

Answer A B C D E F other

5. "Ten days later: The symptoms and signs are the same as last time but in addition the following is noted: the right leg shows hyperreflexia (graded as 3+), a positive sign of Babinski on the right and slight hypoaesthesia of the right leg."

Answer A B C D E F

other_____

5. CASE SCENARIO B

Please read the following cases and for each case, give the answer that you consider fits best with the decision you would make in a clinical setting.

We have selected an imaginary patient, as described in the box below. Then, different scenarios for this patient are outlined, and you are asked to select ONE of several clinical solutions (A,B,C, etc) as listed in bold letters below.

You can choose between the following management options for each of the cases presented below:

A. **I would refer the patient to another health care practitioner for a second opinion.**
B. **I would advise the patient to seek additional treatment whilst following the patient.**
C. **I would tell the patient that the treatment is completed but that he is welcome to make a new appointment if the problem returns.**
D. **I would not consider the treatment to be fully completed and would try a few more treatments and perhaps change my treatment strategy, until I am sure that I cannot do any more.**
E. **I would follow this patient for a while, attempting to prolong the time period between visits until either the patient is asymptomatic or until we have found a suitable time lapse between check-ups to keep the patient symptom-free.**
F. **I would recommend that the patient continue with regular visits, as long as clinical findings indicate treatment (eg spinal dysfunction or subluxation) even if the patient is symptom-free.**
G. **None of the above. (Please explain at the bottom of this page in legible handwriting).**

These are the basic facts for our hypothetical patient.

"A 40-year old man who consults with you for low back pain (LBP) with no additional spinal or musculoskeletal problems, and with no other health problems.
His x-rays are normal for his age. There are no "red flags".

The case above could proceed in the **following 9 ways** described on the next page.

Please encircle the letter that corresponds best to your clinical judgement in each of the cases.

CODE __

__

1. An acute attack of LBP of 2 days´ duration and no previous history of LBP. The pain is completely gone after 2 visits. The patient seems to be an uncomplicated person and capable to look after himself and his back.
What would you recommend? A B C D E F (G)

2. An acute attack of LBP of 2 days´duration and no previous history of LBP. The pain is completely gone after 2 visits. The patient is very worried that the pain will come back again. The patient asks if he could come back regularly to make sure this will not happen.
What would you recommend? A B C D E F (G)

3. An acute attack of LBP of 2 days´ duration and no previous history of LBP. The pain is about 20% better after 6 visits.
What would you recommend? A B C D E F (G)

4. An acute attack of LBP of 1 week´s duration. The patient has had several similar attacks over the past 12 months. The pain is completely gone after 2 weeks of treatment.
What would you recommend? A B C D E F (G)

5. An acute attack of LBP of 1 week´s duration. The patient has had several similar attacks over the past 12 months, but the pain pattern has varied over the treatment period and now, after six visits, the pain is 20% better.
What would you recommend? A B C D E F (G)

6. The patient has had LBP intermittently over the past year. After the 2nd visit, the pain was 50% better but today, after six visits there has been no further change.
What would you recommend? A B C D E F (G)

7. The patient has had LBP intermittently over the past year. After 6 visits, the pain was 80% better, but after a further two treatments the last month, the problem has gradually got a bit worse. **What would you recommend? A BC D E F (G)**

8. The patient has had LBP intermittently over the past year. After the 2nd visit the pain was 20% better, but today, after 6 visits and over the past month, the patient has got gradually worse.
What would you recommend? A B C D E F (G)

9. The patient has had LBP intermittently over the past year. After 6 visits the pain is 20% better. The symptoms come and go for no apparent reason. The patient appears tired and moody.
What would you recommend? A B C D E F (G)

1. On a scale from 0 - 10, how confident in general are you of your accuracy in these cases

0	1	2	3	4	5	6	7	8	9	10

Not all confident 50% confident 100% confident

2. IUS-12 Please circle the number that best corresponds to how much you agree with each item.

	Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely characteristic of me
1. Unforeseen events upset me greatly.	1	2	3	4	5
2. It frustrates me not having all the information I need.	1	2	3	4	5
3. Uncertainty keeps me from living a full life.	1	2	3	4	5
4. One should always look ahead so as to avoid surprises.	1	2	3	4	5
5. A small unforeseen event can spoil everything, even with the best of planning.	1	2	3	4	5
6. When it's time to act, uncertainty paralyses me.	1	2	3	4	5
7. When I am uncertain I can't function very well.	1	2	3	4	5
8. I always want to know what the future has in store for me.	1	2	3	4	5
9. I can't stand being taken by surprise.	1	2	3	4	5
10. The smallest doubt can stop me from acting.	1	2	3	4	5
11. I should be able to organize everything in advance.	1	2	3	4	5
12. I must get away from all uncertain situations.	1	2	3	4	5

3. **The Big Five Inventory-2 Self-Report Form:** Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who *likes to spend time with others*? Please place a mark next to the statement to indicate the extent to which you agree or disagree with that statement.

	I am someone who	**Disagree strongly 1**	**Disagree a little 2**	**Neutral; no opinion 3**	**Agree a little 4**	**Agree strongly 5**
1	Is outgoing, sociable					
2	Is compassionate, has a soft heart					
3	Tends to be disorganised					
4	Is relaxed, handles stress well					
5	Has few artistic interests					
6	Has an assertive personality					
7	Is respectful, treats others with respect					
8	Tends to be lazy					
9	Stays optimistic after experiencing a setback					
10	Is curious about many different things					
11	Rarely feels excited or eager					
12	Tends to find fault with others					

13	Is dependable, steady					
14	Is moody, has up-and-down mood swings					
15	Is inventive, finds clever ways to do things					
16	Tends to be quiet					
17	Feels little sympathy for others					
18	Is systematic, likes to keep things in order					
19	Can be tense					
20	Is fascinated by art, music, or literature					
21	Is dominant, acts as a leader					
22	Starts arguments with others					
23	Has difficulty getting started on tasks					
24	Feels secure, comfortable with self					
25	Avoids intellectual, philosophical discussions					
26	Is less active than other people					

27	Has a forgiving nature					
28	Can be somewhat careless					
29	Is emotionally stable, not easily upset					
30	Has little creativity					
31	Is sometimes shy, introverted					
32	Is helpful and unselfish with others					
33	Keeps things neat and tidy					
34	Worries a lot					
35	Values art and beauty					
36	Finds it hard to influence people					
37	Is sometimes rude to others					
38	Is efficient, gets things done					
39	Often feel sad					
40	Is complex, a deep thinker					
41	Is full of energy					
42	Is suspicious of others' intentions					

43	Is reliable, can always be counted on					
44	Keeps my emotions under control					
45	Has difficulty imagining things					
46	Is talkative					
47	Can be cold and uncaring					
48	Leaves a mess, doesn't clean up					
49	Rarely feels anxious or afraid					
50	Thinks poetry and plays are boring					
51	Prefers to have others take charge					
52	Is polite, courteous to others					
53	Is persistent, works until the task is finished					
54	Tends to feel depressed, blue					
55	Has little interest in abstract ideas					
56	Shows a lot of enthusiasm					
57	Assumes the best about people					

58	Sometimes behaves irresponsibly					
59	Is temperamental, gets emotional easily					
60	Is original, comes up with new ideas					

1. What is your sex? Male / female
2. What is your age in years?
3. Please estimate the number of X-rays that you have requested or have taken yourself for the last 10 new patients? ___ ?
4. In general, which of the following reasons are consistent with why you request or take X-rays for patients? Mark all that apply.
    a. Assess after trauma
    b. Assess osteoarthritis (OA)
    c. Assess osteopaenia or osteoporosis
    d. Assess spinal curves or scoliosis
    e. Assess red flags
    f. Rule out contraindications to spinal adjustments/manipulation e.g., congenital abnormalities
    g. Identify subluxations
    h. Assess patient progress
    i. Other . . . .
5. How many patients do you see on average each week?
6. How many hours do you spend treating patients each week?
7. How many years have you been practicing as a chiropractor?
8. Over the past **1 week**, approximately what percentage of your patients would you have **informally referred** to their GP or another medical specialist (e.g., suggested that they visit their GP). ____ %
9. Over the past **1 week**, approximately what percentage of your patients would you have **formally referred** to their GP or another medical specialist and included a report by way of a letter or phone call? ____ %

Additional File 2. Research Team Explanation of Scores.

Neck Pain Case [201].

Below is a description of the 5 specific management strategies for the neck pain case scenario receiving chiropractic care from which the participants in the survey could select one for each of 5 scenarios. The history was for a 28-year old man, tennis player by profession, presenting with right-sided intense neck pain.

The five options were :

- **A.** I would treat the patient on my own.
- **B.** I would treat the patient with the assistance of some paramedics & / or physiotherapist.
- **C.** I would treat the patient with the assistance of a general practitioner.
- **D.** I would treat the patient whilst asking the opinion of a specialist such as a neurologist / rheumatologist.
- **E.** I would not treat the patient but refer him out.
- **F.** Other, please explain at the bottom of the page.

A description of the 5 scenarios, together with the clinical reasoning (cases 1-5) of the research team for the preferred management strategy for each scenario is provided below.

Case 1. "*Physical examination: very tense cervical musculature, no neuro-vascular problems, right C5-6 painful on palpation, pain 7/10 on a visual analogue scale*". According to the research team, this case indicates a person without a background of persistent or recurrent neck pain. It is uncomplicated and with no poor psychological profile which is indicative of a good prognosis. The team would have selected strategy A ('I would treat the patient on my own'). As such referral or co-management was unwarranted and deemed to be an unnecessary strategy and an incorrect response.

Case 2. "*Five days later the patient comes back to you: Same clinical signs but the pain now radiates into the right shoulder*".

Although the pain had spread to the shoulder, there was no other additional neurological progression or other signs or symptoms of deterioration. This case was thought by the team as best being thought of as uncomplicated non-specific neck pain. As such referral or co-management was unwarranted and deemed to be an unnecessary strategy. Thus the strategy the team would have selected would have been A ('I would treat the patient on my own').

Case 3. "*Four days later: An MRI reveals a postero-lateral disc herniation at C5-6 which affects the C6 nerve root. There is now a neurological sign: C6 reflex diminished (1+), normal myotomes and dermatome*s."
The thoughts of the research team were that this patient had not improved as should be expected. Conservative care had not generated any positive response and hard neurological signs as well progressively deteriorating symptoms were now evident. The team felt that a change of strategy, referral or second opinion would be a reasonable clinical decision. Thus they would have selected B, C, D, or E. However, the DTR C6 reflex could be potentially regarded as equivocal, thus the response of A was thought not to be unreasonable.

Case 4. "*Another 4 days later: The neck pain is gone. The neurological signs are obvious: C6 reflex absent (graded as 0), the C6 myotome diminished (graded as 2), C6 dermatome disturbed (reduced sensitivity).*"
This patient is not improving at a level that should be expected despite the number of visits. The patient is resistant to the type of treatment that has been provided so far. There has been evidence of progressive neurological deterioration and symptomatology. The team determined that more treatment was not warranted. Further, the patient should be referred out and that this referral should have the capacity for advanced imaging as well as more aggressive interventions. Thus the team determined the strategy should have been E ('I would not treat the patient but refer him out"). Any other choice was deemed to be incorrect.

Case 5. *The pain drawing is the same and the accompanying text said: "Ten days later: The symptoms and signs are the same as last time but in addition the following is noted: the right leg shows hyperreflexia (graded as 3+), a positive sign of Babinski on the*

right and slight hypoaesthesia of the right leg."

There has now been a considerable time lapse with significant and serious signs and symptoms. The team determined that this was now a serious scenario well beyond the scope of conservative care and would require immediate referral. The team would have selected E as the appropriate strategy ('I would not treat the patient but refer him out"). Any other choice was deemed to be incorrect.

Low Back Pain Case [202].

A description of nine scenarios (cases 1 – 9), together with the clinical reasoning of the research team, and a description of their preferred management strategy for each scenario (not included in the questionnaire) is provided below.

Inappropriate "Referral" Strategy; Scenarios 1, 2, and 4.

Case 1. An acute attack of LBP of 2 days' duration and no previous history of LBP. The pain is completely gone after 2 visits. The patient seems to be an uncomplicated person and capable to look after himself and his back.

According to the Axen et al., 2008 research team, this case indicates a person without a background of persistent or recurrent LBP, with a quick recovery and a psychological profile that indicates a good prognosis. The Axen et al., team would have selected strategy C ("I would tell the patient that the treatment is completed but that he is welcome to make a new appointment if the problem returns").

Case 2. An acute attack of LBP of 2 days' duration and no previous history of LBP. The pain is completely gone after 2 visits. The patient is very worried that the pain will come back again. The patient asks if he could come back regularly to make sure this will not happen.

The thoughts of the Axen et al., research team were that, ideally, this patient should be dismissed, similarly to the case above (strategy C). However, the psychological profile of this patient needs to be taken into account and he should be provided with a sense of security whilst guided by the chiropractor and gradually weaned off to prevent dependency upon chiropractic treatment. The Axen et al., team therefore selected

strategy E, with the intent of using a couple of more visits to improve the patient's self-confidence.

Case 3. An acute attack of LBP of 2 days' duration and no previous history of LBP. The pain is about 20% better after 6 visits.

This patient was not improving at a level and rate that should be expected. Because the basic case states that there are no red flags, the Axen et al., team decided that this case should be reconsidered and a few more attempts made. The strategy that best suited for this scenario was D.

Case 4. An acute attack of LBP of 1 week's duration. The patient has had several similar attacks over the past 12 months. The pain is completely gone after 2 weeks of treatment.

This is a recurrent problem according to the past history. If the patient considers that the chiropractic treatment shortened the duration of the typical attack, he should simply return as soon as a new problem is felt to commence. Unfortunately, many patients will fail to do so, thinking that the treatment did not help when it starts up again. The Axen et al., team decided that it might therefore be advantageous to keep an eye on the patient for a while with the intent of finding out if each event of LBP can be quickly and efficiently treated at a "cost-effect " time interval (strategy E) or if it is possible to prevent further events (strategy F).

Inappropriate "Management" Strategy; Scenarios 6, 7, 8 and 9.

Case 5. An acute attack of LBP of 1 week's duration. The patient has had several similar attacks over the past 12 months, but the pain pattern has varied over the treatment period and now, after six visits, the pain is 20% better.

This patient is not improving at a level that should be expected despite the large number of visits, indicating that he may be resistant to the type of treatment that has been provided so far. Axen et al., decided that a change of strategy would be required (strategy D) or if the patient is referred out, it would be relevant to keep in touch to be able to be of support in the continued process (strategy B).

Case 6. The patient has had LBP intermittently over the past year. After the 2nd visit, the pain was 50% better but today, after six visits there has been no further change.
The study by Axen et al., interpreted this patient as having reached his optimal stage with the present type of treatment and the therapy should, at this stage, either be reconsidered "in-house" or by someone else, indicating strategy A or D.

Case 7. The patient has had LBP intermittently over the past year. After 6 visits, the pain was 80% better, but after a further two treatments the last month, the problem has gradually got a bit worse.
The Axen et al., team used the following reasoning: The improvement seen, to date, may have been independent of the treatment and merely an expression of the typical intermittent pain pattern, or the treatment did have an effect but there is something that re-aggravated the condition. The Axen et al., team therefore reconsidered the case (strategy D) or sent the patient out for an adjunctive approach, such as training, whilst keeping in touch (strategy B).

Case 8. The patient has had LBP intermittently over the past year. After the 2nd visit the pain was 20% better, but today, after 6 visits and over the past month, the patient has gradually got worse.
This patient has not really exhibited a positive response to the treatment and is, in fact, getting worse. That the patient is gradually worsening is not a normal pattern. Despite the fact that there are no (obvious) red flags the team would refer the patient for a second opinion (strategy A), because some underlying explanatory condition could have been missed.

Case 9. The patient has had LBP intermittently over the past year. After 6 visits the pain is 20% better. The symptoms come and go for no apparent reason. The patient appears tired and moody.
This patient has not improved at all and there is no obvious (biomechanical) explanation for the intermittent pattern. There are no red flags but there is a need to consider if there might not be an underlying depression or some other disease, after all. The team would not hesitate to refer out for a second opinion (strategy A).

Chapter 7 Additional File: Interview Questions

Aide de Memoire / Interview questions.

Opening questions:

"Can you tell me generally about your involvement with the CCE?"

"Can you tell me what you see as the challenges for CCEs improving the standards of Chiropractic education?"

Sub-question 1.

Open-ended question: What are your views about implementing identical graduating chiropractor competency standards for all CCEs?

Is there anything you would like to change in the domains of competencies for graduating chiropractors?

Prompts: Could you talk more about ...? Can you explain that more?

Prompts that relate to previous studies would include – "In our research to date we have found or concluded that

- There is a need for an appropriate definition of a chiropractor
- There is potential for ambiguity in the use of terms between CCEs
- There is a need for common domains for all CCEs
- There is a need evidence based knowledge content in competencies
- There is insufficient emphasis placed on ethical and professional practice behaviours
- involvement in research exploring optimal structures and educative processes that produce the required competencies.

Do you have any comment on this finding or conclusion?

Concluding question: That's all I would like to ask, is there anything else you'd like to talk about or ask me regarding this issue?

Sub-question 2.

Open-ended question: What are your views about implementing identical accreditation standards for all CCE?

Is there anything you would like to change in the domains of accrediting standards for CPs?

Prompts: Could you talk more about...? Can you explain that more?
Prompts that relate to previous studies would include – "In our research to date we have found or concluded that:

- there is a need for a definition of education standards
- should there be a domain for distance education?
- all accreditation standards should be based on literature reviews
- the development of accreditation standards should take on board input from all stakeholders
- chiropractic students should (at least in part) have hospitals experience
- there should be minimal levels of qualifications for chiropractic faculty (e.g. industry standard of PhD),
- Chiropractic program (CP) curricula should be taught in a multimodal format
- There should be core material for all CPs
- CP mission statement should have a social responsibility
- There should be a minimal set of financial standards for all CPs

Do you have any comment on this finding or conclusion?

- *Concluding question*: That's all I would like to ask, is there anything else you'd like to talk about or ask me regarding this issue?

Sub-question 3.

Open-ended question: What are your views on the CCEs role in CPs to ensure that students learn relevant clinical course material? For example, learning the contra-indications for chiropractic care?

Prompts: Could you talk more about...? Can you explain that more?

Prompts that relate to previous studies would include – "In our research to date we have found or concluded that:

- non-indications for chiropractic care are poorly understood

Do you have any comment on this finding or conclusion?

Concluding question: That's all I would like to ask, is there anything else you'd like to talk about or ask me regarding this issue?

Sub-question 4.

Open-ended question: What are your views on CCEs requiring CPs to teach students about understanding their own personality, attitudes or beliefs and how these may impact on their clinical decisions?

Prompts: Could you talk more about...? Can you explain that more?
Prompts that relate to previous studies would include – "In our research to date we have found or concluded that:

- Intolerance of uncertainty impacts negatively on clinical decision making
- There are non-evidence based beliefs such as "SMT helps immune system, prevents disease in general, and prevents spinal degeneration" that suggests less than optimal care will be delivered by these students

Do you have any comment on this finding or conclusion?

Concluding question: That's all I would like to ask, is there anything else you'd like to talk about or ask me regarding this issue?

Sub-question 5.

Open-ended question: What are your views about the inclusion of vitalism into CP course material? What are your views on the inclusion of EBP into CP course material?

Prompts: Could you talk more about...? Can you explain that more?

Prompts that relate to previous studies would include – "In our research to date we have found or concluded that:

- There is no specific mention of Vitalism in CCE standards
- There is no specific mention of EBP in CCE standards.

Do you have any comment on this finding or conclusion?

Concluding question: That's all I would like to ask, is there anything else you'd like to talk about or ask me regarding this issue?

Closing instructions:

"We would like to thank you for your time today. Are there any final comments you would like to make or any question you would like to ask? If you would like to learn about the results of this study then I am happy to send you an abstract of the final published study".

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